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Vol. VI. NEW YORK, AUGUST 29, 1885. No. 9.

NOTHING of material importance has been added this week to the revelations regarding the alleged negotiations for the sale of the Baltimore & Ohio telegraph system to the Western Union Company. It cannot be said that all the mystery has been cleared away, and a great many people would, like ourselves, be glad to read in full the correspondence that passed between the negotiators. To expect its production is perhaps expecting too much, neither company being able to go further in the way of explaining matters without self-incrimination.

THE Immediate Delivery system to be inaugurated by the Post Office Department on October 1st, to be first given a trial in Philadelphia, has already waked up the American District service. A proposition from the latter concern to assume charge of that system in Philadelphia has been declined by the Government, Acting Postmaster-General Stevenson stating that the law contemplates the maintenance by the department of its own delivery system. This is as it should be; for, while we entertain some doubt of the propriety of a Government, backed by enormous wealth, entering into business competition with its own citizens, we believe that even Government competition is better than a monopoly of any kind.

EVERYBODY in New York is watching with great interest the tests of the Daft motor on the Ninth Avenue Elevated road. We have the pleasure of reporting, from personal observation, that on Wednesday night, in spite of the rustiness of the track and other troubles incidental to a start of the kind, Mr. Daft's motor, "Benjamin Franklin," showed its power, moving freely up and down the track. As we have already traveled behind a Daft motor at other places, at the rate of several miles an hour, we think we can now promise our fellow New Yorkers an early ride on the Elevated by electricity. Meantime the electric tramway which was equipped with the Daft motors at Baltimore is in regular operation. It has now been running for over two weeks, and nothing has yet occurred to make the undertaking anything but a decided success. Indeed the tramway company is so well pleased that it has ordered two more motors, which will be put upon the line as soon as possible. The ascent of the heavy grades on this line is a remarkable feature, one grade being of 350 feet to the mile; yet no difficulty is experienced in overcoming it. The success of th s undertaking marks another decided advance in the application of electricity in this country, and it will not fail to strengthen the confidence of the advocates of electric railways.

THE present issue of THE ELECTRICAL WORLD consists of no fewer than 28 pages—14 of reading matter and 14 of advertisements. That so large a paper devoted to electricity can be published in the very dullest portion of the summer, and at a time when business still suffers from depression, will be noted with pleasure by every friend of electrical journalism. As to the character of the contents, we think it may fairly be claimed for them that they are of the highest interest and value. Finding that extra space would be required to do justice to the important papers read at the conventions of the Old-Timers, the Military Telegraphers, and the Electric Light Association, we have provided ample room in which to give those papers and to supplement our copious reports of last week. We have, moreover, given three pages to the report of the Franklin Institute Committee on the duration and efficiency of incandescent lamps tested at Philadelphia recently. In short, no electrician, whatever his business, can afford to make other than a careful perusal of this issue. The advertisements, by their variety and number, are a marked recognition of the efforts of this journal to represent adequately the science and applications of electricity, and are also an evidence of the esteem in which it is held as a medium through which to reach all classes of consumers engaged in the electrical field.

AMONG some of the interesting relics brought by Old-Timers to this city during the recent convention was an old-time Morse key, the property of Mr. B. F. Gilmore, of Chambersburg, Penn. Placed beside one of modern workmanship, it seemed nothing more than a pump handle. No spring, no platina points, with a nail for a circuit closer, it emphasizes our rapid progress and the vast improvements which are now going on. The Old-Timers—and new-timers, too, for that matter—have doubtless noticed the adoption by the Associated Press of the type-writer, by which an operator reading by sound sends out beautifully printed and perfectly punctuated "copy." The Associated Press men are making rapid progress in this novel plan of receiving, and there is reason to believe that it is only the beginning of a radical change in serving the public. We believe that the telegraph company which shall first adopt the type-writer for copying received messages—at least on its through wires—and shall keep those hieroglyphics known as "checks" off the copy that is sent out, will outstrip its rivals in popular favor. After the Associated Press has demonstrated the theory, some enterprising company will adopt it. This will, of course, lead to a higher standard of operators and better pay. Meanwhile, our young men should try to get their hands in, for we believe that the accomplished Morse operator, stenographer and type-writer is the "coming man" in the field telegraphic.

THIS summer has been remarkable for the number of accidents reported as due to lightning. We have given the details in some of the more curious cases, without attempting, however, to chronicle every fatal lightning stroke, or to count up the thousands of dollars' worth of property destroyed by fire originating from the same cause. Some of the latest freaks of Jove in slinging his bolts, as reported in country papers, are unusually strange. Thus five horses, at Camillus, N. Y., laid their necks across a wire fence, last Friday, when the lightning struck it 60 yards away, and all the horses were killed. Then a correspondent of the Florida *Union* informs us that he "saw a phenomenon in the way of a child who was in the schooner Lillian when she was struck by lightning some weeks ago. The child's hair was white. He was severely stunned by the lightning, and the next morning his hair was discovered to be dark auburn." This is a good recipe for some of our gray-haired Old-Timers. But the most remarkable story comes from Perry, N. Y., where, on the 22d inst., according to the special correspondent, "lightning struck the residence of John Rudgers, a ball of fire, two inches in diameter, coming in through the roof and rolling over the carpet. Rudgers, in his bare feet, sprang upon the ball and crushed it out. His feet were terribly burned, and he received a shock from which he did not recover for several hours." These and various fatal lightning strokes and the curious freaks of similar occurrences have led one of our esteemed contemporaries to calculate on the chances of a person being killed in this summary manner. It finds that the odds are 900,000 to 1 that you are not killed by lightning in a storm; 300,000 to 1 that you are not hurt at all, and that a wayfarer on the street stands in far greater danger of being run over by a passing vehicle than of being injured during the fiercest flashes of lightning. Statistics of electrical storms compiled for many years in France indicate that a man's chance of injury from lightning has only been one in 1,200,000 during the past fifty years.

WE publish to-day the Franklin Institute report on the recent efficiency and life tests, at Philadelphia, of incandescent lamps, and thus give our readers an opportunity of getting more definite information on a subject which has been, until recently, a matter of speculation. The testing committee consisted of J. B. Murdock, lieutenant U. S. Navy; Louis Duncan, Ph. D., ensign U. S. Navy; Wm. D. Marks, Whitney Professor of Dynamic Engineering, Univ. of Pennsylvania; and G. W. Ward, M. D., Photometric Expert of the Trustees of the Philadelphia Gas Works. An examination of the methods employed fails to bring out any weak points, and indeed the arrangements must be considered eminently practical and convenient. The reputation of the members constituting the committee gives a stamp of authority to their work and puts a decided value on the results. But the results as such can hardly be characterized as brilliant or final, though they serve a good purpose in showing where improvement must be looked for. Examining the efficiency test, we find the most economical lamp consuming on an average 3.544 watts per candle, or 216.1 candles per electric horse-power. The duration test will perhaps prove to be of even greater interest than the efficiency tests. The results show the Edison lamps furnished to have possessed excellent qualities. It will be noted, however, that these as well as the others fell considerably in illuminating power during the duration of the test. It is to be regretted that Mr. Weston should have been placed in the awkward position which is fully explained in the report. A strict adherence to the code was, however, decided to be necessary, and hence his lamps were subjected to the full test, notwithstanding his protest. It is curious, also, to note that in some cases among the same lot of lamps the majority broke down comparatively early, while one or two would last the full time. The cause of this should be studied and the conditions determining this increased life investigated. Altogether the report will be found of interest, the more so as it is the only one extant in which the *life* of the lamps is taken into consideration and arrived at with any degree of precision.

THE law directs that two sergeants of the Signal Service shall each year be promoted according to merit to be commissioned officers, but we doubt if a non-commissioned officer who has devoted some years to a particular training, meteorological and otherwise, would care for a commission, if he must be obliged to report to the regiment to which he is nominally assigned after a few years of the peculiar service for which he has been specially educated. A thorough and reliable meteorologist would in the natural course of events cut a very poor figure as a "tenderfoot" out West, where many of his brother officers have for years done the State no more service than that which is termed "roughing it." Of course, if military telegraph lines are to be built out West, our Signal Service men should be there, but we have grave fears as to the propriety of taking an experienced man from "S. O." in Washington periodically and sending him to forage for elk and antelope in the neighborhood of Laramie Peak. We have never joined in the somewhat popular cry for a total separation of the Signal Service from the army, but we believe that the Signal Service should be in some way set apart without being different from the regular army. The English sappers and miners are somewhat different from the line, and do different duty, but we think that our Signal men come nearer to the "Royal Engineers" of that splendid army. An example of the way in which our Signal Service may possibly be crippled is afforded in the recent order from Washington, directing "line" officers who have been on detached duty for four years to return to their regiments. This order, of course, includes First Lieutenant A. W. Greely, of the Fifth Cavalry; First Lieutenant Robert Craig, of the Fourth Artillery, and H. H. C. Dunwoody, all of whom should properly be classed "of the Signal Service," and that alone. In the case of Lieutenant Greely, particularly, we must admit that he has been on detached duty for four years, but if that period is to include three years at the North Pole with nothing to eat except an occasional banquet off the north wind with a trifle of hyperborean ice, we should, for our part, prefer not to serve on "detached" duty for any length of time. The fact is that our Signal men are recruited for the Signal Service; they are promoted in that branch of the military department, are familiar with al its requirements, and they should, we think, be allowed to remain there during their good behaviour.

"Old-Time" Telegraphy.*

BY C. C. HASKINS.

Commencing telegraphy at 19 years old, in 1846, was quite a different thing from accepting the position of operator to-day. There were no chiefs, no circuit managers, in those days; there was not even a night trick, for a telegrapher or a battery man who was not out of his office, his day's work done, by 9 or 10 o'clock at the most, was looked upon as either very hard worked or extremely lazy, and in either case to be pitied.

Early in the year mentioned, the firm of Livingston & Wells contracted with the projectors of the work to build a line from New York to Buffalo, along the line of the Hudson and the New York Central. The project was so new, however, that throughout the western portion of the State there was much skepticism as to the possibility of a telegraph line being successfully operated to make it commercially profitable. There were grave doubts in the minds of capitalists whether an electrical current could be depended upon to correctly record in what was looked upon as a faulty alphabet a veritable translation of a written message, and the likelihood of error in transcribing from these ambiguous dots and dashes—or, as they were sometimes called, "strokes and pips"—was another serious objection to its possible usefulness. This feeling was so universal among those who were importuned to take stock and risk their money in the new enterprise, that it was finally thought best to construct a sample line in the western portion of the State which would demonstrate the feasibility of the electric telegraph.

The route selected for this general exhibit lay along the old one-horse railroad from Buffalo to Lockport—a road run, by the way, with apartment cars, like coach bodies; a group of three of these built together, with entrances at the side, the seats ranged crosswise of the track, being one car.

Upon this line, which was strung with the softest of copper wire, of about No. 4 gauge, an insulator about the size of the present pony was used, the single wire being fastened by two half-hitches in the wire. The ductility of the conductor rendered it necessary to be constantly taking up the slack, which was done by winding the wire around the insulator. This elongation of the line, which was by no means equal at all points, produced a unique-looking insulator at times, when several of these turns were wound upon the glass.

Two offices—the terminals—were opened with a grand flourish of newspaper articles, and wonderful was the result of the announcement. From morning till night the Buffalo office was crowded with sight-seers, who were constantly importuning the operator (I think it was Swan) for a piece of the paper, "and please mark the letters, so I can read it," was so frequently an accompaniment that this marking became the rule, rather than the exception, where samples were handed over the little railing that separated the wonderful artist from the ignorant horde without.

Complimentary messages of every description were sent between the two towns, and in most instances the papers, with the cabalistic characters translated, were delivered with the message, as proof of the genuineness of the—I had almost said "dispatch." We called it a "communication" in those days.

While this was amply sufficient in the case of a merely complimentary dispatch where there was no money at stake, further corroboration was required when it came to business, and I know personally of one instance where a flour commission man wrote an order for a shipment, which he sent by mail, and duplicated by telegraph, after having dropped his letter in the post-office.

The instruments used, if wonderful then, would be curiosities now. The key was a sort of camel-back institution, weighing complete near half a pound, and I don't know but nearly a pound. It was clumsy in the extreme. The anvil was disconnected and required to be fitted into a hole nearly an inch in diameter through the heavy plank table at which the operators stood. The register had three pen points to avoid any possible error which might arise from a lump or a hole in the paper. An ingenious arrangement of pins on one of the train wheels made contact with a bell hammer, and at the same time relieved the fly-wheel of a friction brake, so that a short succession of dots made by the operator set the register going, without the necessity of calling or attending to the paper until it was convenient to do so. This was looked upon as wonderfully convenient, and it was considered a great accomplishment. But it had its drawbacks, for in order to be ready at all times for work it was necessary to use the closed circuit system, which was impossible without great waste of battery, and our batteries were expensive. The sulphate of copper battery had not yet been invented, and our motive power was generated by the Grove combination, which rapidly deteriorated, and the nitric acid soon ate up the zincs.

Our relays were a heavy factor, too, in the problem. These contained eight coils, set up in pairs, the armatures arranged like the letter X, with the perpendicular shaft through the centre of the cross. Attached to one of these arms was the retractile spring and on another was the local connection. The relay complete weighed about 21 pounds.

The battery was all taken down at shutting-up time, the porous cups emptied into a demijohn, which was carefully corked to prevent deterioration during the night. The zincs were carefully washed and brushed, and any which were in the least oxidized were boiled in dilute sulphuric acid and re-amalgamated. In the morning a mixture of one-half fresh and one half of the previous day's nitric acid was used for setting up the battery. There was no battery man. The duty of attending to the cells devolved upon the operators, who all, save the manager, took their regular turn, where there was more than one person in the office.

The rapid running down of the battery when on closed circuit, rendered it necessary that some means be devised by which this could be economized. To accomplish this it was an imperative rule that whoever received a message became the custodian of the circuit, and must hold it until the line was wanted by another office. This holding consisted in making occasional dots. Half an hour or even more was by no means long to hold circuit, especially at about noon. Any operator wishing to use the line had only to open his key, which at the next close of the key keeping circuit told the story, and relieved the circuit holder.

Among the abbreviations which all apprentices were compelled to learn, were four, s f b, s f d, s f s, and s f n, indicating stop for breakfast, dinner, supper and night, and these we were compelled to use. One operator whom I knew on the Canada line, whose office was often hard to raise, was recommended by the superintendent to add a fifth to this list, s f f, stop to go fishing.

The use of any one of these four abbreviations was an exception to the general rule that where any operator broke circuit he became its keeper, and at about twelve o'clock it was not infrequent for operators to pitch upon some individual, and to use a modern phrase, give him a roast. To do this it was only necessary to call him up and ask the time. Upon his answering, one after another along the line would chip in with s f d, and the poor fellow would be elected to make dots for a long hour, with not a soul on the line for himself.

With the introduction of the Daniell, or sulphate of copper, battery this great drawback to the enterprise was removed. Previous to this, however, an attempt was made to utilize the office clock for this duty, but the application proved a disgusting failure on one occasion when the office was left alone while the clock was performing this duty, for which the brilliant inventor received anything but recommendation from the superintendent, Sam Porter, who wanted the circuit badly, but could not make the clock understand the situation.

When the line was to be connected through Lockport to Canada, the operator could not be made to comprehend how the line could possibly work without his ground wire, and it became necessary to send a man from Buffalo to remove the Lockport ground.

All repairs were done, as a rule, by the operators, except where the breaks were near the terminal or larger offices. These were of a temporary character usually, and were subsequently made permanent by linemen. In small offices, the office was locked up, a notice posted on the window or door, and the operator and his girl went out on line with a buggy or light lumber wagon, as facilities permitted. On lines of railroads, the repairers usually had a three-wheeled hand-car, which had occasionally to make rapid time ahead of an engine run by a mischievous engineer. We all had a chance at these races on the New York Central in the early days.

In the sparsely inhabited districts, the operator, unused to climbing, before the days of spurs, when an ascent of the pole was imperative, made the best bargain possible with some country lad, who climbed the pole, or two, perhaps, to drop the wire so that a connection could be made, and the loop thus formed usually hung until the next trip of the regular repairer, who carried a ladder and other tools in his wagon.

The line from Queenston, Canada, to Lockport, ran through the Cattraugus Indian reservation. On the occasion of a break in the single wire, it became my duty as operator at the former office to foot it over the line in search of the trouble. It had been broken close to the Indian village, but a patriotic native had mended the break by tying in a piece of clothes-line.

As the public became more familiar with the "new improvement," as it was sometimes called, additional lines were strung, the old copper wires were replaced by iron, repairing became a more difficult matter, and the operators were only too glad in the majority of cases to give up the work, which was better done by better hands.

Then came opposition. Bitter fights and ill-feeling between rival companies descended from employer to employé, and open war was in some instances the result of factional pride. One instance of the extent to which this was carried may serve to illustrate the ingenuity with which methods were invented to down the opposition.

In a small town in Michigan two operators had long contested for the small business of the place. The office of the younger operator was fast losing the custom of his former friends, who had been estranged from him by the oily tongue of his opponent. "Since I am maligned and abused in this way," thought he, "nothing but a bit of strategy will help me out of my dilemma." One Saturday night, after both offices had closed, he entered the office of the other company, and with a fine wire stripped from an old relay he made cleverly concealed connection from the window on either side to the zinc beneath the stove. This zinc was in two pieces, without metallic connection. The cracks in the floor and down the casement completely hid the wire. Now, when the operator stirred his fire and threw the poker on the zinc so as to bridge between the two pieces, his relay was cut out. This action was so irregular as to make the trouble exceedingly difficult to find, but of sufficiently frequent occurrence to effectually prevent the handling of business promptly, and the result was eminently satisfactory to the strategist and his employers.

The mystery was never explained except to a very narrow circle, of whom the writer is one, and the trap after having been in successful operation for over a week was one night removed by the young strategist.

Both parties are still living, gray-haired old men, yet I doubt if either has forgotton the circumstances, one remembering it as a freak, the other as a successful piece of jugglery.

If in the above I shall have afforded those who may hear as much pleasure as has been mine in recalling these few incidents of "Old-Time" telegraphers, I shall feel highly gratified.

* Read before the Old-Timers' Association, New York, August 20, 1885.

A Phenomenon in Arc Lamps.

BY H. H. LEVETT.

A curious phenomenon is noticed if the negative carbon of an ordinary arc lamp is replaced by a piece of copper filed to a blunt point. Instead of fusing, there is merely a slight melting of the point on first starting, after which there is no further melting of the copper.

There seems to be a deposition of carbon particles carried from the positive electrode of carbon to the negative electrode of copper which tends to shield the copper.

I had a piece of copper taking the place of carbon for three weeks without perceptible diminution in weight.

My experiments were conducted on a circuit of 20 ampères, and length of arc of $\frac{1}{32}$ in.

The Electric Light in Coal Mines.

Our recent comments on the electric light in mines are borne out in the number of mines which are being rapidly fitted up with the light. We stated at the time that a systematic study of the conditions involved would make mine lighting as successful as any other. In this connection, the description of the recent fitting up of a coal mine in Yorkshire, England, will prove interesting.

Not only are the main roads and pit bottom lighted, but the light has been carried right to the working faces. At the bottom of the shaft a main hauling road runs to the end of the pit a distance of some 150 yards, while parallel with this another road runs for the same length, turning off at the extreme end for about 130 yards at right angles. The working faces of the pit are reached by gangways running at right angles with these roads at distances varying from 50 to 60 yards. The dynamo, a "Blakey-Emmott," 2½ unit compound wound, is fixed with a small engine at the bottom of the shaft, and the cables are run down one of the main roads, while branches are taken therefrom direct to the workings, passing first through a switch which is hermetically sealed. Sufficient slack of wire is provided outside the workings to enable the miner to place his lamp wherever it may be required. The lamp is covered with a thicker glass shade and also with a wire screen, to reduce the risk of breakage to a minimum. Down each of the main hauling roads lamps are fixed and controlled by a switch at the dynamo, the facing lamps being controlled by the smaller sealed switch already named, so that each man on leaving work can turn his light out on reaching the main road.

Not Controlled by Gould.

A Chicago correspondent writes as follows to one of the Boston papers: "There is a rumor here that Gould has gotten a strong hold on the American Bell Telephone Company of your city. The bond of intimacy existing between the two companies by reason of the contract, in which the Western Union participates to the extent of 20 per cent. of the gross receipts, gives a color to it as well as the resignation of Theodore N. Vail and O. E. Madden, managers. The former of these gentlemen made the business and organized the company to a great commercial success. It will no doubt run the stock down to a low point if this information proves true. It has hurt the local stocks somewhat."

Our contemporary remarks: "The correspondent is logical in his conclusions, for the acquirement of a strong hold upon the company by Mr. Gould would no doubt be the signal for conservative New England holders to sell out. The trouble is with the correspondent's premises, and he may assure himself that the retirement of the general manager and his assistant were in nowise attributable to Gould influence, and that the company will continue, as heretofore, a New England or Boston property, under Boston management. Mr. Gould has his hands full at present trying to annihilate telegraphic opposition to his Western Union Company, without buying control of the telephone."

The Thomson-Houston Factory, Lynn, Mass.

The Thomson-Houston machines and lamps are built at Lynn, near Boston, Mass. The factory consists of a large three-story brick building in the shape of an L, in the interior angle of which is a separate building containing boilers, engine and various accessories. On the ground floor of the main building are the machine tools at which the castings are received and finished. Here, also, the field magnets are wound.

The floor above, Fig. 2, is specially devoted to the testing of machines and lamps. The room in which the latter are placed is entirely protected from air drafts, so that the arcs may burn quietly and not be troubled from that cause. This story also contains machines for making arc lamps. The second story, Fig. 3, is devoted to winding of the armatures and of the magnets for the lamps.

Here also are constructed various small details of the mechanisms which require precision. On the same story are situated the testing laboratories, and a workshop for manufacturing incandescent lamps.

In passing through the factory, one is struck by the excellent arrangement manifest everywhere and the ingenuity displayed in the special machinery employed.

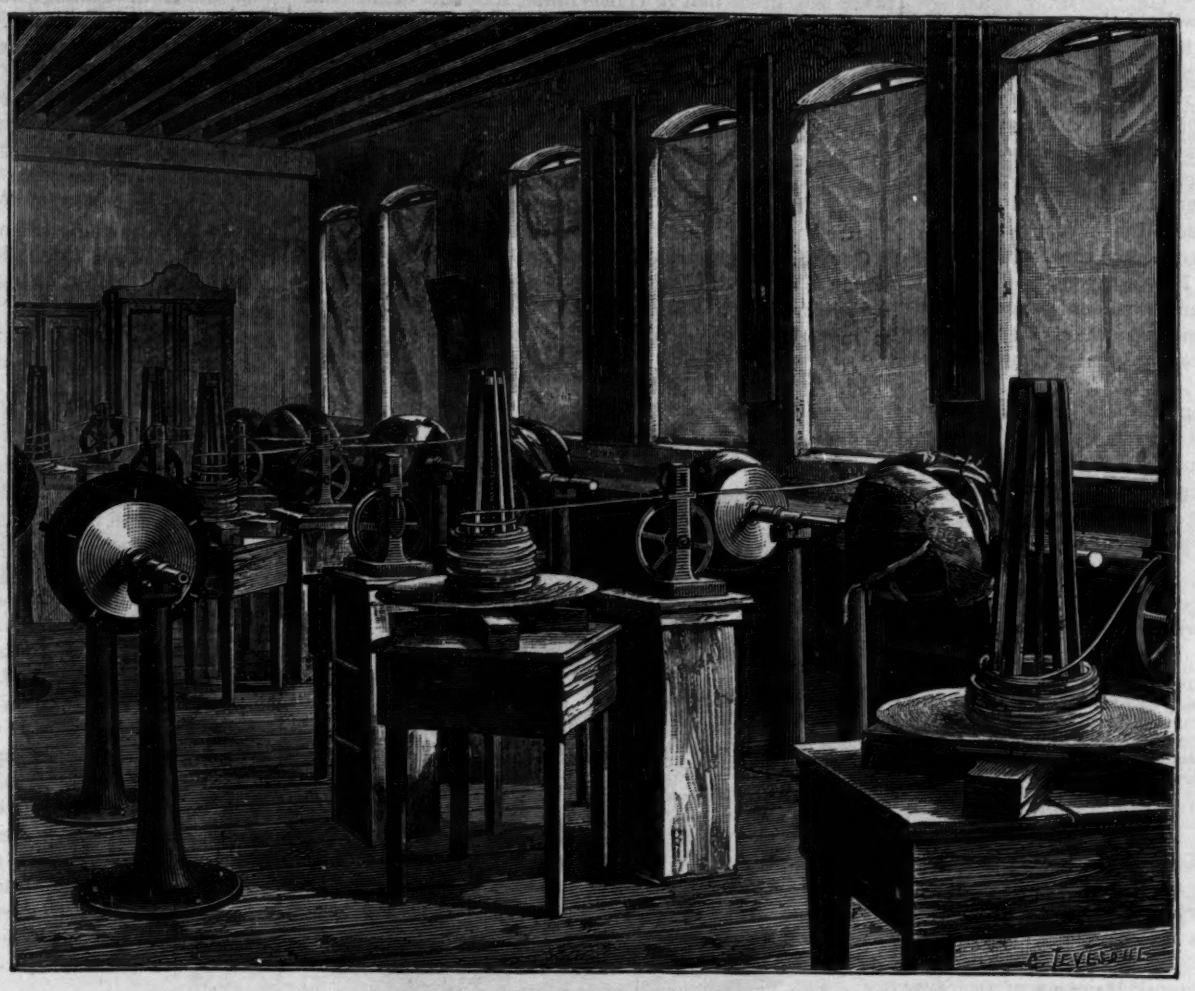


FIG. 1.—THOMSON-HOUSTON FACTORY, LYNN, MASS.—WINDING ROOM.

We described fully the Thomson Houston dynamo and lamps several months ago, and need not, therefore, enter into another description, as the machine has not been essentially altered, though improved in some small details. It may be noted here that though the system is one of the latest to enter the field, and has yet to become widely known in England, it has just taken the gold medal at the Inventions Exhibition in London, as the best of the systems put in competition there.

A Visit to the "Callender" Works.

As noted in our report of the National Electric Light Association meeting last week, Mr. Callender, of the Callender Insulating and Waterproofing Company, extended to the members of the convention an invitation to inspect his cable works at East Newark, N. J., and on the evening of Friday, August 21, about fifty gentlemen assembled at the Erie depot for the purpose. A special train, which had been provided, took the party to the door of the works, which were brilliantly illuminated by over forty arc lamps of the Thomson-Houston and Excelsior patterns, running on long underground Callender circuits. Under the guidance of the Messrs. Callender and of their Superintendent, Mr. A. P. Henderson, the visitors were shown all the details of manufacture, both of the core and of the insulating material, "bitite." The latter is a product of the natural bitumen, which, when combined with some other substances and vulcanized, yields a material not unlike rubber or gutta-percha. It possesses high insulating qualities, and resists all corroding influence

The cores of the cables are made by ingenious machines and the bitite is applied in the usual way of passing the core through a die, and forcing the material upon it as it is drawn through. Several braiding machines for covering wires were also shown in operation.

After the works had been thoroughly inspected, a collation was served in one of the offices, and Mr. Callender welcomed his guests in a neat address. He remarked that he had no doubts of success here as in England, and that he relied upon the American characteristic of "knowing a good thing when they see it." Dr. Lugo followed in a short speech in corroboration of Mr. Callender, and Mr. R. W. Pope also made a few appropriate remarks. The hour for the return of the train having arrived, the company took their leave with a cheer for Mr. Callender, all being well pleased with their visit. The Callender Company deserve great credit for their enterprise, and the fine new buildings they have erected and their improved machinery give them ample opportunities for supplying a large demand.

A full and authorative illustrated description of the Callender system was given in our issue of November 15, 1884, page 194.

FIG. 2.—THOMSON-HOUSTON FACTORY, LYNN, MASS.—TESTING ROOM.

Telephone Rates.

There is grumbling in New England again over telephone rates. All telephone subscribers in Peabody, Mass., have, it is stated, been notified that after Sept. 15 the rental for each instrument will be increased from the present rate of $48 per annum to $50, as the company think that they they are not sufficiently remunerated at the present price. Peabody has now some sixty or sixty-five telephones, many of which do the principal part of their telephoning with cities and towns outside the district, and for such service an extra charge of from 15 to 25 cents is made, in addition to the regular rental. If the increase in rental is to be made, it is claimed, the subscribers should certainly be given a larger district, one that will include Boston, Lynn, Gloucester and Newburyport.

A considerable number of the telephone subscribers in Salem will, it is said, order their instruments discontinued on account of the advance in rent of instruments by the telephone company.

The idea has become prevalent that the rates should be lowered instead of raised, on the ground that the concessions made by the parent company to the licensees enables this to be done. The following table of royalty for each receiver and transmitter under the new arrangement will show that reduction of subscriptions can be attempted and made only in a few places:

	Net royalty for each instrument.
Exchange subscribers paying $24 per annum, or less, for exchange service	$3.00
Do. exceeding $24 and not exceeding $27 per annum, do.	3.12½
Do. exceeding $27 and not exceeding $30 per annum, do.	3.37½
Do. exceeding $30 and not exceeding $33 per annum, do.	3.87½
Do. exceeding $33 and not exceeding $36 per annum, do.	4.50
Do. exceeding $36 and not exceeding $39 per annum, do,	5.25
Do. exceeding $39 and not exceeding $42 per annum, do.	6.00
Do. exceeding $42 and not exceeding $45 per annum, do.	6.75

Where subscribers pay above $45 per annum, present net royalties stand.

Where the present contract relations and discounts give a less net royalty than the net royalty herein named, the present contract will be followed.

The Salem, Mass., *News* has the following on the subject:

W. J. Denver, Assistant General Manager of the New England Telephone & Telegraph Company, called at the *News* office yesterday afternoon, and made a few statements regarding the recent increase in rates. He stated that the corporation is now heavily in debt, its stock is down to $34 per share, and the stockholders have not received any dividends for three years. The directors of the company recently decided that the concern was not paying expenses, and was not likely to, therefore an increase in rentals was the only alternative left, as the working expenses have been reduced to the lowest possible point consistent with efficient service. This, according to Mr. Denver, is the only reason why the rates have been increased.

Mr. Denver said many people had an idea that the New England company is connected and shares the profits of the Bell company, but that is an error. The New England exchange is operated as a distinct concern, simply leasing the instruments from the Bell company, which owns all the patents and is paying enormous dividends. The cost of maintaining the lines has been heavy all over New England the past winter, several large losses having been met with on account of the elements, and this tended to further increase the liabilities of the concern.

Regarding the cost of maintaining the telephones, Mr. Denver said that the public had gained a wrong impression. He claims that the actual expense for every instrument per annum is $44.13, this having been proved by statistics. In the face of this fact the gentleman did not consider that the company was in any way exacting when it demanded enough from the public to leave a slight margin of profit or a surplus for accidents, etc., and also to pay the stockholders a dividend occasionally. In addition to the great expense of the telephone, the wires and poles have to be renewed about once in five years, so that according to Mr. Denver's ideas and figures, a very small margin will be left even with the increased rates.

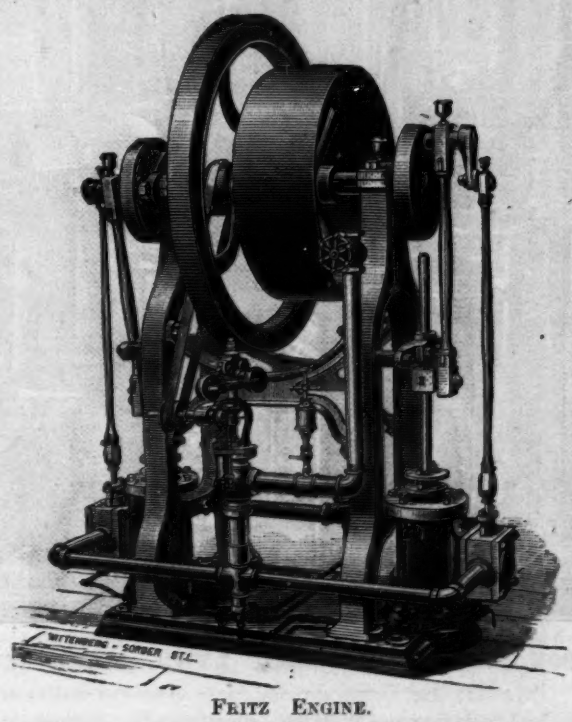
It appears that the increase applies only to business places, which are advanced from $43 to $50. Residences, except those provided with the Currier bell, are reduced from $43 to $40, so that in reality the increase is not so general as first expected.

The grievance of Beverly subscribers, who complain because they are obliged to pay $7 a year more than those in Peabody and Salem, was touched upon by Mr. Denver, who said that the extra expense of maintaining the long line of wires made an increased rate necessary. The distance is so great that it comes under the rule of the company which calls for higher rates than is charged subscribers within a mile of the exchange.

In conclusion, the representative of the company said that his statements could be easily and quickly substantiated by consulting the financial columns of the Boston daily papers.

The "Fritz" Electric Light Engine.

Our engraving represents a self-contained double engine, which is mounted on a single bed-plate, and thus occupies very little space. These engines are built in a substantial manner, being fitted with self-adjusting piston packing,



Fritz Engine.

steel piston rods, gun-metal boxes and babbitted bearings. They are built by Mr. Geo. J. Fritz, of St. Louis, Mo., who also makes several sizes of the single engine similar in general design to the one illustrated. Quite a number of Mississippi River steamboats run their electric lights with this engine, which has given good satisfaction.

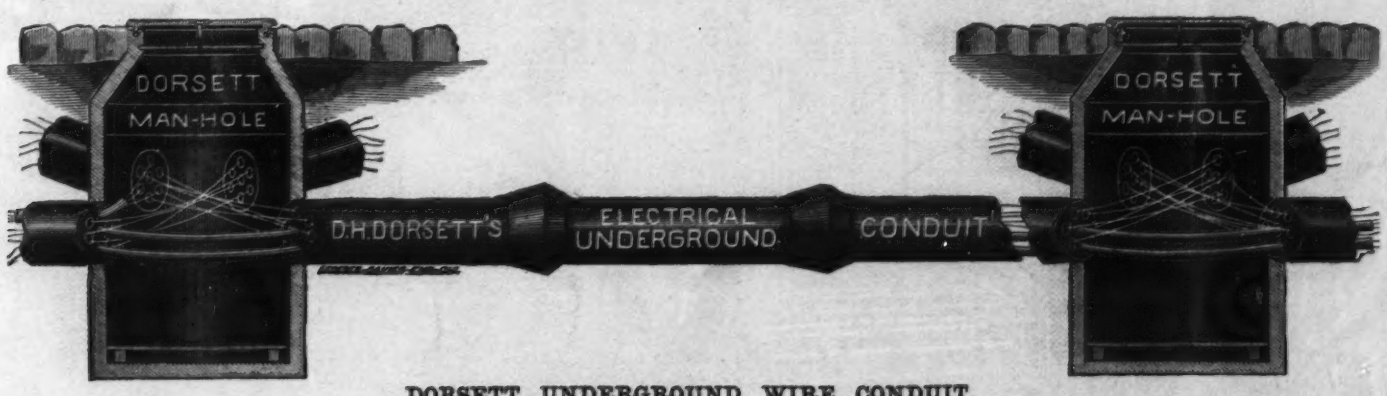
The Dorsett Underground Conduit.

The underground wire question is such a live one that any description of a system in actual operation and the results obtained is of interest.

The city of Chicago has for about a year been employing an underground conduit for its wires, and various other electric companies have found room therein. This Dorsett conduit is constructed, with but little variation of the original material—asphaltum and pure silex—in the same manner as the Dorsett sewer pipe, which has been used for six years for sewerage and drainage, buried at varying depths in the soil, and subjected to a temperature of 27° below zero without injury. It is molded in longitudinal sections under a hammering pressure of several thousand pounds, while hot, and almost fluid, and when cold resists a crushing strain of 5,500 pounds to the square inch, according to government tests made in 1883. So compact is the material that an inside hydraulic pressure of 180 pounds is incapable of forcing the least moisture through a thickness of one inch. This conduit is made in sections of three feet, of a diameter of ten inches, and is perforated with seven two-inch holes. Our engraving gives a good idea of its appearance. The sections are flanged for joining up, and the juncture is sealed or cemented as the sections are put together. So homogeneous does the conduit become that these connections are a strength instead of a weakness, and upon applying tests it is ascertained that the line of junction has disappeared. The cement used is a material poured on the section in a boiling hot-condition. It may here be added that the material of the conduit is an excellent insulator.

The man-holes are located at street corners or other fit places. The material used in their construction is the same as is used for the conduits. The man-hole cover is of iron, and is so fitted with springs that it has sufficient elasticity to be safe from breakage under extreme pressure. Water is quite excluded by it also. To prevent mischievous tampering with the wires, an inner diaphragm is provided, and this is secured by a lock. As soon as the cables or individual wires have been drawn through, the man-holes are locked by the service company, as the representative or guardian for the other electric companies, and access later can only be had by an authorized agent or with his supervision. In Chicago, the company that operates this system, and of which Prof. Elisha Gray is president, has put down already more than six miles of this Dorsett conduit. Half the capacity is now rented, and a guarantee is given in every lease that a reliable service shall be maintained to the extent of the liability of the conduit company. It is stated that the rental charged per mile is not equal to 10 per cent. of the charges made by the telegraph companies for the use of their wires or poles. We learn that the wires of the Chicago city fire alarm, telegraph, telephone, electric light and police systems running to the City Hall are all carried into the building through Dorsett conduits, where they were placed during the summer of 1884. The Chicago conduits were placed beneath the thoroughfares of the city, at depths below which the soil was solidly frozen by the low temperature of an exceptionally cold season. Up to the present time no break or injury has been experienced, and not one dollar has been expended for repairs upon the city wires of this system. The Chicago Telephone Company have also occupied a half-mile of these pipes with 300 wires for a year.

As regards electric light wires, it is stated that wires are being laid in the conduits by the several electric light companies. As an experiment, an electric light circuit on which there are about 40 arc lights burning nightly, runs for nearly one street square, where there is no other insulation between the naked wire and the ground, save the conduit proper.



DORSETT UNDERGROUND WIRE CONDUIT.

Removal of Telephone Poles.

Suit was brought to compel the removal of a telephone pole erected at the inner angle of the sidewalk forming the corner of two of the principal streets in New Orleans. The defense was made that the post was constructed with State and municipal authority for the purpose of supporting the wires used, and was necessary for the transmission of messages. In this case—Irwin *vs.* Great Southern Telephone Company—the defendant succeeded on the trial, and the plaintiff appealed to the Supreme Court of Louisiana, where the judgment was affirmed. The Chief Justice, Bermudez, in the opinion, said: "The power of the State and of municipal corporations over public and common property, to regulate the use of it for purposes of public utility, is no longer a mooted question where no constitutional rights are infringed. It is well defined to be the rightful authority which exists in every sovereignty to control and regulate those rights of a public nature which pertain to its citizens in common, and to appropriate individual property for the public benefit as the public safety, necessity, convenience or welfare may demand. Citizens have, nevertheless, the right to complain of nuisances; but this they can successfully do only where the effects are not common to every person, but produce, by the invasion of some vested right, a special or particular damage to them, as distinguished from the public generally. For injuries that are consequential—that is, the results of acts done within the scope of the power granted, arising from a proper exercise of the same, and which can in no sense amount to an actual taking of property or divestiture of acquired right—no remedy, however, can be had. We are satisfied that this pole was put up after proper authority was obtained, and that all proper precautions were taken to make as little inconvenience as possible to the plaintiff and to the public. If the construction and use of the pole be an actual nuisance at all, it is such as does not materially interfere with the comfortable enjoyment of plaintiff's property, and as causes little or no harm or injury to any one, which is easily bearable, and which has to be endured in view of the great public service which the use of it renders."

The Philadelphia Incandescent Lamp Tests.

The plan for a duration or life test of incandescent lamps was organized during the Electrical Exhibition by the Executive Committee. It had been recognized that tests of incandescent lamps for the determination of the efficiency alone afforded no data for deciding upon their relative value, the lifetime of the lamp being an important factor in the question of economy. A test which should furnish information on this point would be very valuable. Plans were early made for such a test, but as the time required was such that it could not be conducted by the Photometric Group of the Board of Examiners, it was placed in charge of a special committee and invitations were extended to the principal incandescent light companies to enter their lamps. Before the necessary arrangements could be completed several of the members of the special committee were compelled by their engagements to leave Philadelphia.

The Board of Managers of the Franklin Institute thereupon placed the conduct of the tests in the hands of its president, who filled the vacancies existing in the committee, and authorized preparations for conducting the tests on a larger scale than was possible during the continuance of the Electrical Exhibition. Three rooms in the exhibition building were set apart for the tests.

In order to secure satisfactory results, and prevent needless discussion, a suitable code was agreed upon for the conduct of the tests.

The tests began with the following lamps entered;

20 Weston	110½ volts.	Tamadine carbon
20 Edison	94-100 "	
10 Woodhouse & Rawson	55 "	
10 Stanley-Thompson	96 "	
10 " "	44 "	

The latter lamps were requested to be entered at sixteen candle-power. The committee, after a preliminary trial of several of the lamps, fixed on the potentials of 96 and 44 volts, respectively, for the two grades, as approximately representing that candle power, and the lamps were entered at these potentials.

No official information was furnished the committee as to the process of manufacture of any of the lamps. Their general appearance and the relative size are shown in Fig. 1.

After the test for duration had continued about 500 hours, the Franklin Institute entered three new lots of lamps. These were :

10 Weston lamps (paper carbon)	70 volts.
10 Woodhouse-Rawson lamps	50 "
10 White lamps	50 "

The measurements of the spherical illuminating power of the lamps were made with the object of obtaining the average candle-power of the lamps, and to avoid the doubt as to the total amount of light which might arise from the various forms of carbon (many of them distorted in manufacture) used by different makers.

The average of the illuminating power at these thirty eight points is taken as the mean spherical intensity of illuminating power.

Fig. 2 shows the location of the thirty-eight points. It is a photograph of a Mueller lamp of nearly spherical shape, around which four rubber bands are stretched to show the four meridian circles, and one rubber band to represent the equator. The small black patches show the thirty-eight points from which sixty-five measurements were taken.

From Fig. 4 it will be seen that the holder permitted the lamp to be revolved about two axes at right angles in space.

As the lamps to be measured in the preliminary efficiency test altogether required upward of 10,000 photometric observations, it was quite important to avoid the adjustment of a graduated scale, and the horizontal and vertical axes were therefore fitted with notched plates with 12 notches each and spring catches, as shown.

The Methven standard two-candle slit, Fig. 3, was used in all the photometric measurements. This standard was described in our issue of May 23.

Fig. 5 represents the Standard Letheby-Bunsen Photometer with 60-inch bar, used in the efficiency tests.

Two reflectors in the disc box reflected a circular Bunsen spot in paraffined paper.

The electrical measurements were made in a small room especially prepared for the purpose. The potential of the lamps was measured by a Wiedemann mirror galvanometer in a circuit of high resistance. The instrument employed was made by Hartmann, and was chosen on account of good damping.

The lamp currents were measured by a tangent galvanometer specially constructed for the test by Jas. W. Queen & Co. It consisted of a single coil of six turns No. 8 wire, on a brass frame of 60 cm. diameter. The base was of wood, two feet wide, resting on leveling screws. Both galvanometers stood on large wooden posts, buried two and a half feet in the earth, and out of contact with the floors or walls of the building. The needle and compass were loaned for the test by Mr. Weston. The circle was divided to 10′ and could be read by a magnifying glass to 1′ of arc. The maker's adjustments of the needle in the centre of the galvanometer coil were carefully verified.

The code prescribed the method by which the electrical units should be reproduced, and was strictly adhered to.

The ampère was determined both by the silver voltameter and by calculations of the constant. During the test thirty-eight calibrations were made of the tangent galvanometer by the silver voltameter.

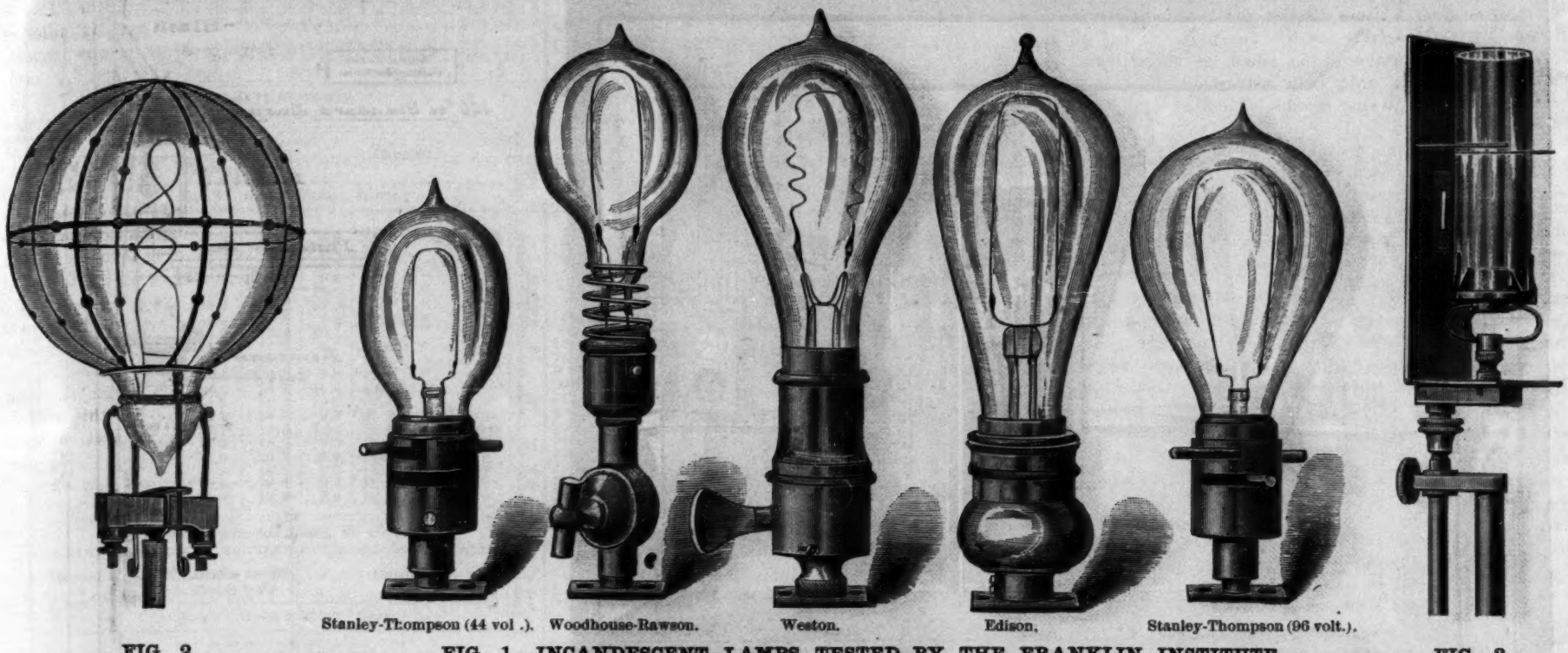


FIG. 2. FIG. 1.—INCANDESCENT LAMPS TESTED BY THE FRANKLIN INSTITUTE. FIG. 3.

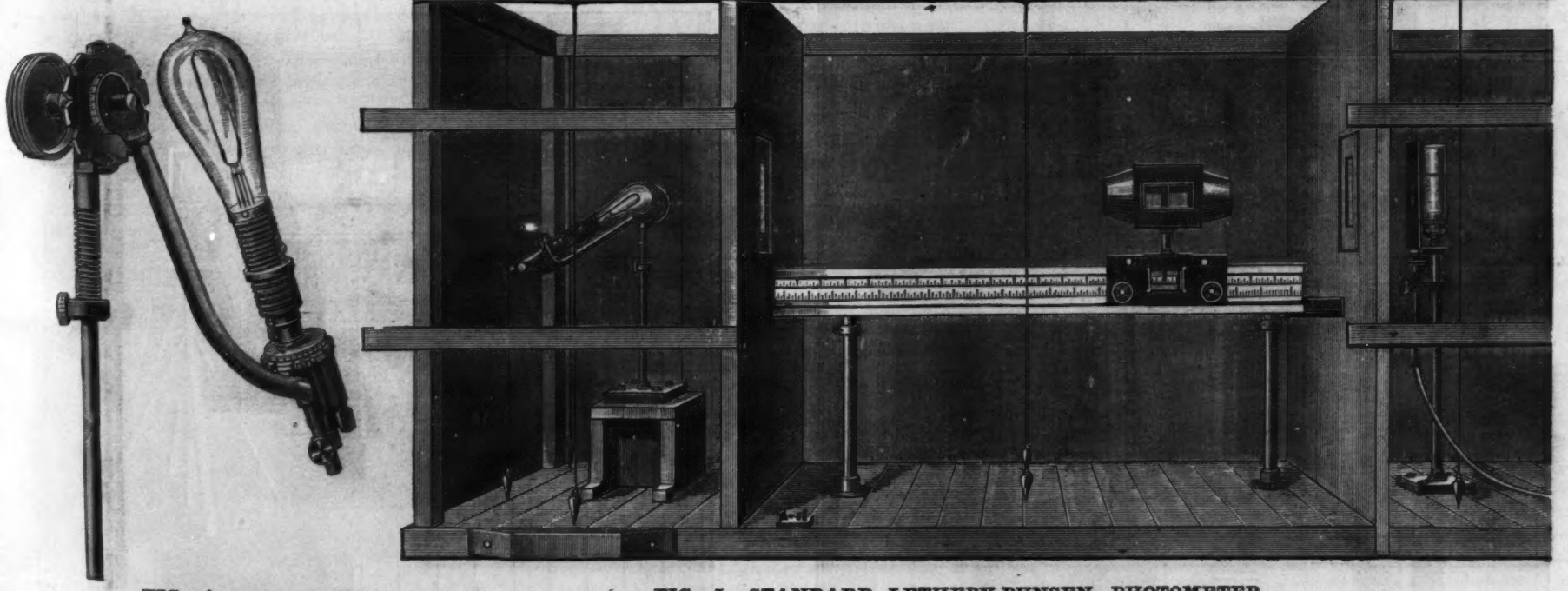


FIG. 4. FIG. 5.—STANDARD LETHEBY-BUNSEN PHOTOMETER.

EDISON LAMPS.

Although only twenty-three lamps were required to be measured for the duration test, a larger number were examined, and the efficiency results are appended. But few peculiarities were observed in these lamps. One, through a peculiar distortion of the carbon, gave an almost circular curve of horizontal distribution, but the curves of the others were essentially the same.

Owing to several obvious causes, the potential of the lamps is generally $\frac{7}{10}$ of a volt higher than the normal. The tables give all the data of the tests. The lamps were taken at random from 400 furnished by the company.

STANLEY-THOMPSON LAMPS (96 VOLTS).

Fourteen of the 96-volt lamps were tested for efficiency, four of the original having been broken in fitting them to sockets preparatory to the test for duration, and four others

tested in their places. The high potential of several of these lamps was due to an error of calculation, which was corrected after the efficiency test.

STANLEY-THOMPSON (44 VOLTS).

These lamps gave the highest average efficiency of any lot under test, but varied considerably from each other. The curves are essentially the same as those of the 96-volt lamps, except in giving less light at the top of the lamp. The lamps were taken at random from a lot of fifty.

WOODHOUSE & RAWSON LAMPS.

Two lots of these lamps were tested. The results obtained were generally the same. The first lot were marked 55 volts, and were taken from twenty-five lamps furnished. The slight irregularities in the curves obtained are due to the fact that the lamp was mounted on a spring socket (Swan) in the efficiency measurements, and the motion and vibration of this socket, in moving it through the various positions occupied, prevented as accurate measurements as in other cases, where the lamp was held rigidly.

The second set of Woodhouse & Rawson lamps, selected from 50 furnished, were marked 50 volts, and a paper accompanying them from the makers invoiced them as "20 candle-power, 50-volt" lamps. They were tested by the committee, as the duration test on the former lot was unsatisfactory, by reason of many of the lamps being connected two in series. On setting the new lot up at 50 volts, they were found to give only 12 spherical candles, and to have an efficiency of about five watts per candle. The Woodhouse & Rawson is known as a very economical lamp, and has of late attracted much interest on that account. A duration test of 300 hours was all that could be allotted to these lamps, and would determine nothing if the lamps were tested at so low candle power. As the resistance of the lamps cold was the same as some of the first lot of 55 volts, the committee determined to test the second lot at that potential also, with a statement of the facts.

WHITE LAMPS.

These lamps were taken from a lot of twenty-four. The carbon is apparently made of thread, has a circular cross-section, and is heavily treated. The cold resistance found during the test was unquestionably an error, but that was not discovered until too late for correction. The lamps decreased in resistance during the duration test. The average cold resistance before use, of several lamps of the same lot, was found to be 102 ohms, and those under test probably averaged about the same.

WESTON LAMPS (110½ VOLTS).

In the report on the tests of these lamps, the committee give a *résumé* of correspondence between Mr. Weston and themselves. The 110½-volt lamps were received from the United States Company in January. Efficiency measurements were made on the 5th, 6th and 7th of February. On the 18th of February, Mr. Weston visited the exhibition building, was shown the results of the efficiency measurements on his lamps, examined into the installation and the working methods of the test, and thinking the candle-power of some of them low, asked for a remeasurement of some of them. They were retested and the accuracy of the former measurements verified. Upon investigating the matter Mr. Weston informed the committee that they had been supplied with a bad lot of lamps; the defect being due to imperfect baking of the loops. He also informed the committee that he considered it useless to spend any more time on the lamps in their possession. In a subsequent communication of the committee to Mr. Weston, the former state that in the light of the above facts they considered Mr. Weston's 110½-volt lamps withdrawn, and inform him that if no new lot of lamps is received at a certain fixed time, the duration test would proceed without the Weston lamps, and the United States Electric Lighting Company would not be regarded as a competitor.

Later, however, the Edison Company objected to Mr. Weston withdrawing his lamps, and there being nothing in the code which provided for such a contingency, the committee felt constrained to continue the test with the original lamps.

WESTON LAMPS (70 VOLTS).

Mr. Weston having expressed a desire to have measurements made on a lot of 70-volt paper carbon lamps, they were entered by the president of the Franklin Institute for test. The distribution of light is almost exactly the same as in the other lot. Ten lamps were selected from a lot of thirty-three received from Mr. Weston, tested for efficiency and afterward subjected to a duration test of 523 hours.

The following table, page 87, gives the averages of the results obtained in the efficiency tests.

For the duration test proper the three rooms of the Brush exhibit during the exhibition were utilized. The lamps were placed in boxes arranged in a circle (Fig. 7) in the middle room, which was securely boarded up, with the exception of one door opening into the watchman's room. This door was securely locked and sealed, except when measurements or adjustments were being made. A glass

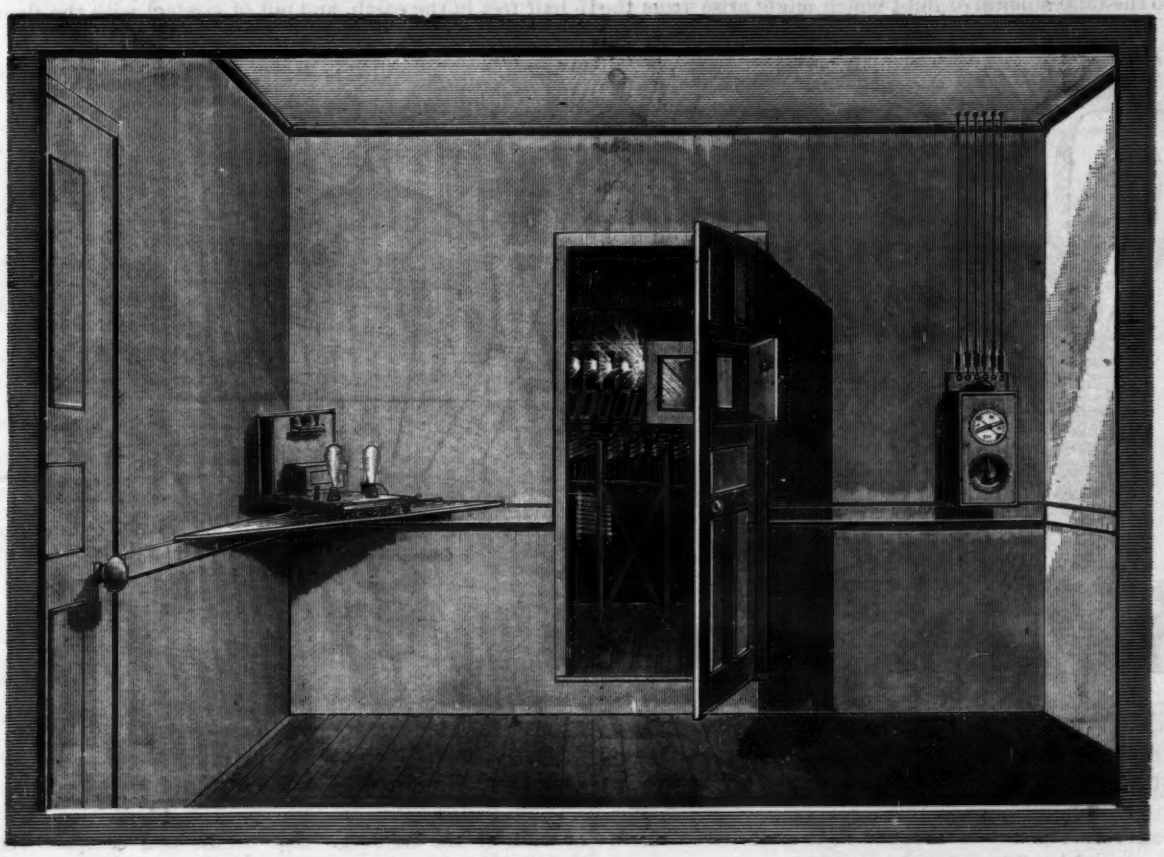


FIG. 6.—VIEW OF TEST ROOM FROM WATCHMAN'S ROOM.

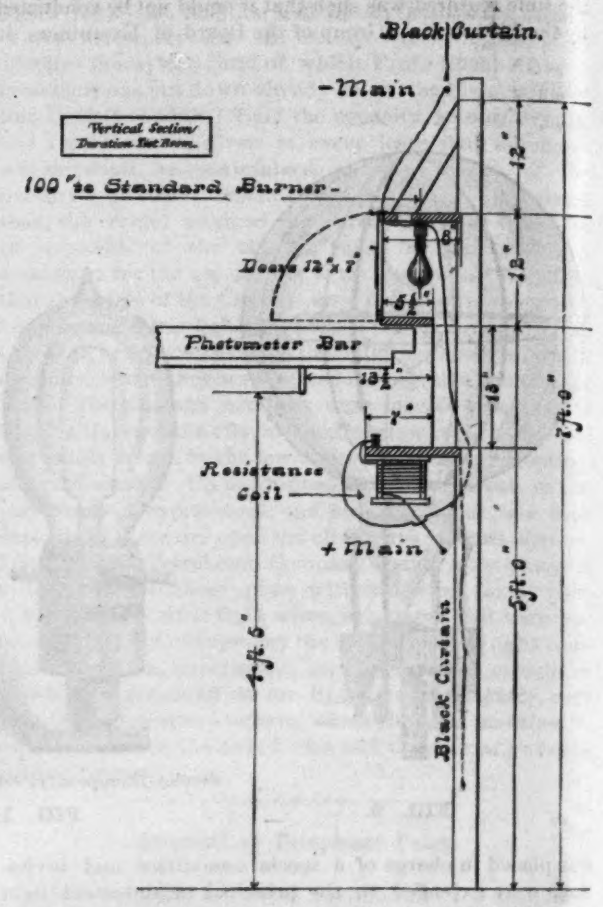
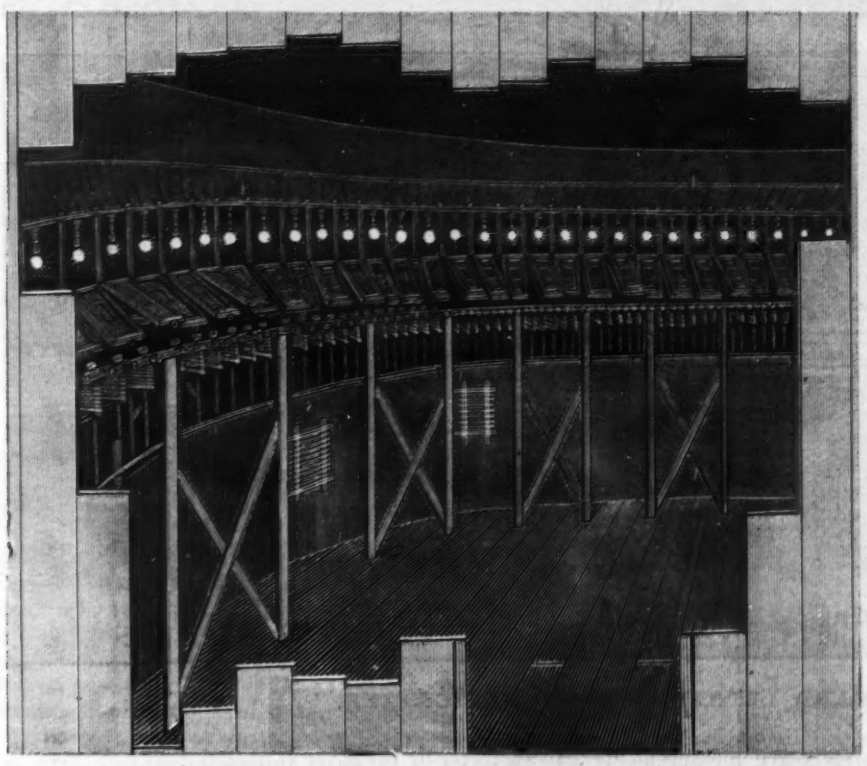
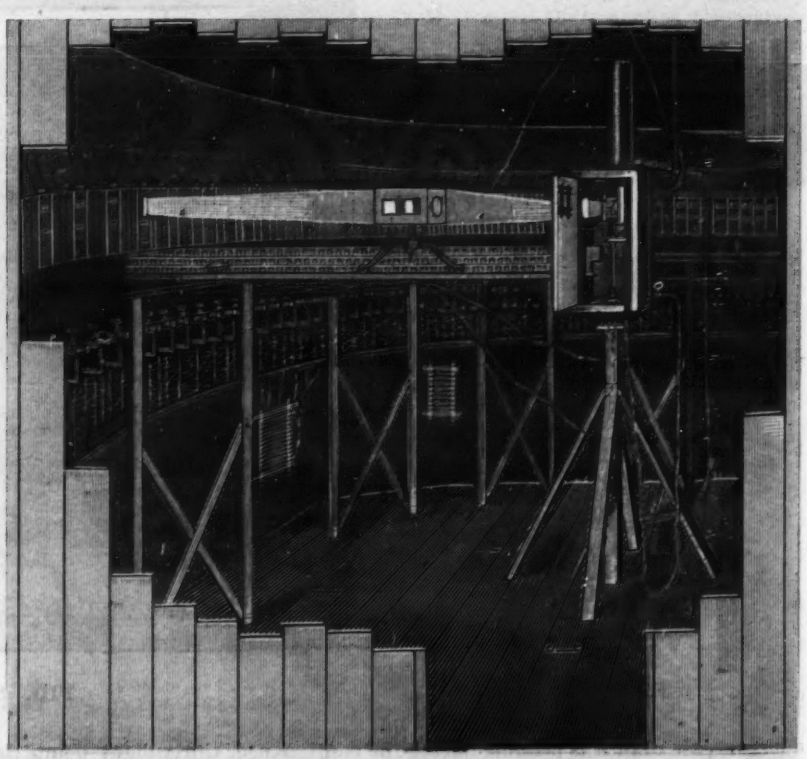


FIG. 9.—VERTICAL SECTION OF TEST ROOM.





FIGS. 7 AND 8.—VIEWS OF TEST ROOM.

EFFICIENCY TESTS.
AVERAGE RESULTS.

LAMP.	Volts.	Amperes.	Watts.	Candles. Mean spherical.	Candles. Mean horizontal.	Watts per spher. cand.	Resistance. Cold.	Resistance. Hot.	Candles per Elec. H. P. Spherical.	Candles per Elec. H. P. Horizontal.
Edison	97.57	.7065	68.92	15.47	19 24	4.459	247.5	....	169.2	210.4
Stanley, 93 volts.	96.56	.554	53.61	13.59	16.30	4.04	315.1	....	189.1	226.3
Stanley, 44 volts.	43.98	1 053	46.32	13.42	16.44	3.544	81.1	....	216.1	264.8
Woodhouse & Rawson, 55 volts (1st lot)...	55.53	1.006	55.82	15.64	18.68	3.605	117.3	....	209.0	249.6
W. & R. (2d lot)..	55.00	1.178	64.77	18.30	22.13	3.56	100.2	....	210.8	254 9
White, 50 volts...	49.99	1.017	50.83	12.44	15.05	4.05	....	....	182.6	220.9
Weston, 110½ volts	111.42	.530	59.04	16.43	18.07	3.713	407.9	....	209.8	230.7
Weston. 70 volts.	70.4	.968	68 09	15 18	16.85	4.51	150.	....	166.3	184.6

DURATION TESTS.
EDISON LAMPS.

Lamp.	Hours of test.	Life of lamp.	Candles. Effic'ncy meas'rem'ts. Sph'r'l	Candles. Effic'ncy meas'rem'ts. Horiz'l.	Candles. Spher.	Candles. Horiz.		Discoloration.
1	1,066	Survived.	15.3	18 8	9.3	11.4	After 1,006 h.	3
2	1,065	"	13.6	16.7	9.9	12.2	" "	2
3	"	"	14.2	17.2	9.7	11.7	" "	2
4	"	"	15.0	18.6	9.6	11.9	" "	2½
5	"	"	15.7	19.5	10.5	13.0	" "	2½
6	"	"	14.0	17.1	10.3	12.7	" "	2½
7	"	"	14.0	17 6	9 3	11.7	" "	2½
8	"	"	16.0	19.4	10.1	12.2	" "	3
9	"	"	14.4	17.7	9.7	11.9	" "	2½
10	"	"	14 0	17.7	9.8	12.4	" "	2
11	"	"	16.1	20.3	9.8	12.4	" "	3
12	"	"	13.1	16 7	10 3	13.1	" "	2
13	"	"	14.9	18.3	10 1	12.4	" "	2½
14	"	"	15 1	19 0	9.3	11.7	" "	3
15	"	295	15.1	19.0	12.4	15.6	" 260 h.	2
16	"	Survived.	15.5	19.6	9.3	11.7	" 1,006 h.	2½
17	"	"	16.0	20.3	8 9	11.3	" "	3
18	"	"	15 0	18.5	9 0	11.1	" "	2½
19	"	"	15.4	18.8	9.5	11 6	" "	2½
20	"	"	15.2	18.9	9.0	11.2	" "	2

STANLEY-THOMPSON LAMPS, 96 VOLTS.

Lamp.	Hours of test.	Life of lamp.	Candles in efficiency tests. Sph'r'l.	Candles in efficiency tests. Horiz'l.	Candles. Spher.	Candles. Horiz.		Discoloration.
26	1,065	78	12 8	15.4	12.3	14.7	After 53 hrs.	2
28	"	233	16.7	19.3	9.2	11 0	" 218 "	3
29	"	176	16 2	19 1	10.1	11.3	" 172 "	3½
30	"	Survived.	12.7	15.4	6.2	7.5	" 1000 "	3
33	"	257	14.0	16 8	8.3	9 8	" 241 "	2
34	"	525	13.9	16.6	8.5	10.2	" 502 "	3½
35	"	100	13 2	16.2	10 4	12.7	" 100 "	2
36	"	301	16.3	19.4	8.4	10.0	" 241 "	3½
37	"	882	13.4	16.1	6.5	7.8	" 837 "	2½
41	"	683	11.9	14.3	7.9	9.5	" 670 "	2½

WESTON LAMPS, 110½ VOLTS.

Lamp.	Hours of test.	Life of Lamp.	Candles in efficiency tests. Spher'l	Candles in efficiency tests. Horiz'l.	Candles. Spher'l	Candles. Horiz'l.		Discoloration.
1	1,065	227	16.6	18.4	10.8	11.9	Hours. After 198	2½
2	1,065	47	13.8	14.9	.....	.....	"	½
3	1,065	Survived.	13.4	14.8	7.1	7.8	Aft. 1,006	2
4	1,065	107	11.7	12.7	3.8	4.2	" 77	1½
5	1,065	320	15.0	16.4	10.4	11.4	" 289	2½
6	1,065	Survived.	10.4	11.2	10.0	10.8	" 1,006	2
7	1,065	"	17.3	19.0	2.9	3.2	" 1,006	2
8	1,065	141	19 2	21.4	10.0	11.1	" 141	2½
9	1,065	Survived.	15.6	17.0	6.5	7.1	" 1,006	2
10	1,065	823	18.2	19.7	10.0	10.9	" 789	2
11	1,065	169	15.4	17.0	2.8	3.1	" 148	1½
12	1,065	81	21.3	23.3	13.9	15.3	" 76	2
13	1,065	256	15.4	17.0	6.0	6.6	" 211	2
14	1,065	213	18.3	20 4	2.6	2.9	" 196	1
15	1,065	193	8.9	9.4	5.5	5 9	" 193	1
16	1,065	Survived.	14.2	15.4	9.1	10.0	" 1,006	3
17	1,065	41	11 3	13.1	.....	.....	"	½
18	1,065	Survived.	15.8	17.0	4.4	4.7	" 1,006	2
19	1,065	65	19.4	21.9	10.7	12.1	" 52	2
20	1,065	Survived.	18.5	19.9	9.5	10.2	" 1,006	2

WESTON LAMPS, 70 VOLTS.

Lamp.	Hours of test.	Life of lamp.	Candles in efficiency tests. Spher'l	Candles in efficiency tests. Horiz'l.	Candles. Spher'l	Candles. Horiz'l.		Discoloration.
51	524	260	14.3	16.0	7.7	8.6	Hours. After 249	2½
54	52	Survived.	14.0	15.2	13.1	14.4	" 465	2
55	524	"	16.7	18.3	14.8	16.3	" 465	2
56	524	"	14.7	16.4	13.9	15.7	" 465	2
58	524	"	16.3	17.9	13.3	14.6	" 465	2½
59	524	223	15.6	17 6	14.9	16.8	" 176	2½
61	524	Survived.	12.7	13.8	12.5	13.7	" 464	2
62	524	"	13.9	15.4	9.9	10.9	" 464	2
63	523	"	14.3	16.3	14.0	16.0	" 463	1½
64	523	463	14.8	16.1	14.0	15.4	" 462	2

pane set in it (Fig. 6) allowed of inspection of the lamps when the door was closed. On the opposite side of the duration test room was a shop in which all necessary electrical work was done. In a corner was the photometer room, containing the photometer used in the efficiency measurements (Fig. 5).

Only one lamp (Stanley No. 12) was accidentally broken in the test, and this occurred while making a connection, by accidentally touching its leading wire to the binding post of the next lamp, giving the lamp 96 volts instead of the 44 required. When the room was open, no one not connected with the test was allowed to enter it unless accompanied by a member of the committee.

The arrangements in the duration test room may be understood from Figs. 8 and 9, the former being from a drawing and the latter being a longitudinal section through the lamp boxes. The lamps were arranged in a circle of one hundred inches radius, the centre of which was occupied by the slit of the Methven burner. This distance was carefully measured and verified.

STANLEY-THOMPSON LAMPS, 44 VOLTS.

Lamp.	Hours of test.	Life of lamp.	Average potent'l.	Candles in efficiency tests. Spher'l	Candles in efficiency tests. Horiz'l.	Candles. Spher.	Candles. Horiz'l.		Discoloration.
1	1,065	309	43.60	11.8	14.6	6.6	7.8	After 290 h.	4½
2	"	143	44.40	10.4	12.5	10.2	12.3	" 101 "	3½
3	"	137	46.85	16.0	19.7	8.0	9.8	" 101 "	4½
4	"	178	43.95	14.2	17.6	9.0	11.2	" 173 "	4½
6	"	288	43 85	10 4	17.1	6.8	8.3	" 280 "	3½
7	"	303	42.40	12.6	15.4	9.5	11.6	" 283 "	4
8	1,047	Surv.	43.65	10.8	13.2	5.4	6.6	" 987 "	4
9	1,065	40	.....	16.6	19 9	.....	.....	.....	2½
10	"	206	43.20	16.3	19.7	10.0	12.1	" 202 "	3½
11	"	275	44.10	15.3	19.4	6.5	8.3	" 265 "	4½
12	865	307*	.....	11.0†	.....	9.2	.....	" 307 "	6

* Accidentally destroyed.
† Standard reading. No reduction factor.

WOODHOUSE & RAWSON LAMPS.

Lamp.	Hours of test.	Life of lamp.	Average potent'l.	Candles in efficiency tests. Spher'l	Candles in efficiency tests. Horiz'l.	Candles. Spher.	Candles. Horiz'l.		Discoloration.
1	1,035	41	.....	18.5	21.5	.....	.....	After	3½
3	1,065	214	55.60	19.7	24.0	13.0	15.9	213 h.	4½
4	1,065	203	54.90	17.8	21.0	12 3	14.5	170 "	4½
5	1,065	440	54.55	13.3	15 6	10.4	12.2	289 "	4½
6	1,065	395	54.15	12.7	14.4	10.9	12.3	289 "	4
7	1,065	423	55.80	14.2	17.7	10.1	12.6	289 "	4½
8	1,065	118	55.75	13.6	16.5	12.8	15.5	78 "	3
9	1,065	716	55.00	17.0	20.4	6.6	7.8	716 "	5
10	1,065	69	55.20	10.8	12.7	12.4	14.6	32 "	2½
18	1,065	278	55.15	14.0	16.9	13 3	16.1	266 "	3½
B									
30	332	Surv.	.....	18.5	22.7	14.8	18.3	273 "	4
31	332	227	.....	17.2	20 9	14.5	17.5	200 "	4
32	332	Surv.	.....	17.4	21.3	13 9	17.1	272 "	3½
33	331	"	.....	19.0	22.7	14 6	17 4	272 "	4
34	331	235	.....	16 9	20.8	16.5	20.3	200 "	3
35	331	272	.....	19 6	23.5	13.5	16.2	272 "	3½
36	331	Surv.	.....	21.4	26.0	12.4	15 0	272 "	4
37	331	177	.....	18.7	22.9	17.6	21.5	151 "	3½
38	331	224	.....	17.9	20.8	17.0	19.7	200 "	4½
00	331	213	.....	.....	20.0*	15 3*	.....	198 "	4

* Standard reading. No reduction factor.

WHITE LAMPS.

Lamp	Hours of test.	Life of lamp.	Candles in efficiency tests. Spher'l	Candles in efficiency tests. Horiz'l.	Candles. Spher'l	Candles. Horiz'l.		Discoloration.
1	312	Survived.	10.8	13 1	15.9	19.2	Hours. After 253	3½
2	312	"	11.0	13.2	14.3	17.2	" 252	2½
3	312	"	9 1	11.1	12.1	14.8	" 252	3
4	311	"	14.2	17 2	14.6	17.7	" 252	3
5	311	"	14.3	17.1	12 1	14 4	" 252	4
6	311	229	14.6	17 6	15.4	18 5	" 227	4
7	311	160	14.0	17.0	15 7	19 0	" 132	3½
8	311	Survived.	11.7	14 2	13.2	16.1	" 250	3
9	311	16?	13.2	15 9	15.6	18 7	" 132	2½
10	310	Survived.	11.6	14.3	11.3	13.9	" 250	3

The circle contained boxes for seventy-one lamps, each box being eight inches wide. The lamp sockets were screwed to brass nipples on the hundred-inch curve. Each box had a door which opened inward and downward. In Fig. 7 the doors are down, in Fig. 8 they are closed. The details of the boxes are shown in Fig. 9. The lamp is seen in its box with the door closed. The back of the box is open, the escape of light in that direction being deadened by reflection on the blackened wall of the room, and still further prevented from affecting the photometer disc by curtains above and below the lamps.

To the binding post was connected one end of the adjustable German-silver resistance, the other end being soldered to the lower main. The reels were of different sizes, the largest being about twelve inches square and two inches wide. Cotton insulated German-silver wire was used, the size varying from 22 to 26, American gauge. The turns were loosely wound on the reel, and the air cooling was in all cases sufficient, no charring of the insulation or short-circuiting of the wire occurring. Some of the lamps required as much as three hundred feet of wire to procure adjustment of potential.

The results of the duration test are given above.

After the test, the discoloration of each lamp was estimated by comparison with six lamps taken as standards. Number one showed the least discoloration and number six the greatest, the latter having its carbon destroyed by too high a potential.

Electric Lighting at Evansville, Ind.

To the Editor of The Electrical World:

SIR: You have already noted that this city has entered into a ten years' contract with the Gas & Electric Light Company (Brush system). No other company was asked to bid. No other company could have competed with them, as they were first in the field and have a large lighting station, with ample machinery and everything to light up the city now at work. Their president is a very popular man, and the superintendent is second to no one in the business. The directors and stockholders are all wealthy bankers and business men.

I, as agent of the United States Electric Light Company, have sold a sixty-light Weston incandescent plant to the *Courier* Company, who have been using a thirty-light machine six months. The *Courier* Company rent lights to the Lottie saloon, Jones & Co.'s livery stable and Caval's drug store for more than enough to pay for running the plant. I have also sold a thirty-light plant to the Melrose Milling Company, which will be started next week. Prospects good for more.

N. M. BOOTH.

The Best Form of Dynamo.*

BY ELMER A. SPERRY.

The review of this subject allotted by our President is rather a delicate task for one belonging to the rank and file of a dynamo builder. The problem of dynamo construction is susceptible of a large number of solutions, each form being the "best" if our claims as manufacturers are to be accredited. There is no distinctive feature, however, from which something cannot be learned.

The art has advanced so far from the experimental stage, that to-day we are enabled to judge of the merits or demerits of a new construction from a practical stand-point, aided only now and then by theoretical considerations. We have learned by costly experience that not always is that dynamo which gives absolutely the highest electrical efficiency, best for commercial results. We have found that the mechanical engineer cannot be ignored in the designing of electrical machinery; that the salient points in the best experience in construction of engines and analogous machinery should be closely studied and followed.

The best dynamo is that which, with good economy, operates continuously with the least expense; one which does not require the constant attention of an expert—by no means, however, underrating the efficiency in an attendant; one which has no delicate parts liable to derangement; one in which all the parts are accessible for cleaning and proper attention. Large journals, heavy framework, substantial construction throughout are not to be overlooked in dynamo machinery, any more than in a locomotive.

A tendency which is becoming less prevalent has been toward developing the greatest possible current with a given size or weight of machine. The construction in this case is generally too delicate, and all parts are over worked to such a degree that they are constantly giving way. The effect of this upon the commercial operator and public generally has been disastrous, establishing the impression that all electrical appliances are inherently unreliable.

The later constructions are more durable, less delicate as to details, and, generally, more satisfactory; although it is true they may occupy a slightly increased floor spa. "

The *armature*, being that part of the dynamo in which the current is primarily produced, may be considered first in order. Its arrangement should be substantial, compact, and with as few irregularities as possible which would tend to fan the air; yet be thoroughly ventilated, which is the most natural means of keeping down the temperature of the conductor. The core should in every case be laminated to prevent the generation of currents in the masses of metal. The armature conductors should not be too large for the same reason; and the mounting of the coils or armature conductor should be such as to avoid abrasion of the insulation from expansion and contraction, or from centrifugal action in or upon the same. They should, moreover, be accessible in all cases for cleaning and repairs. These coils being the seat of the development of electromotive force, they should be so disposed that *every portion*, if possible, is subjected to the inductive influence of the field magnets. I have taken special interest in this feature, and find that the average, in the forms of machines ordinarily cited as examples, is less than 50 per cent. for that portion of each convolution of the generating conductor which is productive of electromotive force; the remainder not only being idle, but offering wasteful resistance to the currents set up in the useful portions. The immense importance of this point will be readily appreciated, and requires no further comment here.

Waste space on the armature should not occur, although unavoidable in some forms, such as the disc-armatures; the mounting and relation of the armature should be such in regard to the field, that not more than two magnetic reversals occur with each revolution.

The winding of the coils *one upon the other* is found to interfere materially in case of repairs, and is sometimes a fruitful source of short-circuiting, but cannot well be avoided in the cylindrical or Siemens form of armature.

The divisions of the armature conductor into coils should be as numerous as is practicable, especially where the electromotive force is high, as it facilitates the insulation of the various parts from each other and lessens the sparking and consequent wear and tear of the collector or commutator. Another effect of increasing importance is a tendency to lessen the undulatory character of the current generated, rendering it more harmless to life, and at the same time reducing its *inductive* effect upon adjacent line-wires, which so annoy our neighbors, who, I regret to say, are not always charitably disposed. (The remarkable facility with which some of our worthy contemporaries either detect or imagine the effect of induction from electric light wires, is only comparable with the sensitiveness of the instruments which they handle.)

The *commutator* should be substantial, the insulation between the segments and at the ends should be ample and of a character not liable to shrink, char, or absorb oil and moisture; the segments should be deep to secure long service; the size should not be too small to secure proper electrical construction, nor so large that the friction of the collecting brushes shall be felt, nor the centrifugal ten-

* Read before the National Electric Light Association, New York, Aug. 20, 1885.

dency on the segments operate to loosen them from their place.

The field-magnets should be given special attention. Their arrangement should be that which would at once strike the practical mind as being the *most natural*. An effort should be made to avoid sharp angles or corners in both polar extensions and the yoke-piece at the rear.

The helices or coils should be of the most regular form, the cylindrical being, perhaps, superior in point of economy.

The disposition of the quantity or masses of metal in various parts of the field-magnet should be also looked to carefully.

In some forms of machines, a small core and coil may be found arranged to maintain the magnetic potential of a comparatively immense mass at the pole-piece. This arrangement is obviously bad. That form of electro-magnet most often met with in telegraph construction is perhaps of all forms the best, and should be followed as closely as possible in designing fields for dynamo machinery. The arrangement of multiple coils parallel to each other for the magnetizing of a single pole-piece is adverse to high efficiency, as the adjacent parts of separate coils tend to mutually demagnetize each other. This effect should also be looked to with regard to the arrangement of other parts of the field-magnets; often the polar extension and yoke or any of the means by which the magnetic circuit is completed are badly arranged as regards one another.

The arrangement of the field as shown in the Gramme continuous current and Weston machines—that is, where the magnetic potential is developed midway in the length of the continuous core or piece of metal—labors under one disadvantage, which may be noticed as follows: Considering only one-half of the entire field of the machine, which would consist now of two coils, a north and south pole and yoke, we have the ordinary electro-magnet; and the opposite complement of parts facing the said first set, although integral therewith, would perform the office of a keeper and tend to satisfy the potential at the poles. The current in the two coils on the opposite side of the poles must then do the double work of, *first*, overcoming this adverse tendency of the lines of force and magnetic potential, and, *secondly*, of aiding in maintaining such potential at the poles. This result is, of course, mutual with regard to the two sets of magnets facing each other. The efficiency, however, of this form of field is brought up to standard from the fact that only one-half of the *mass* of the pole-piece depends upon each coil or helix for the maintenance of its magnetic potential.

The distance between the pole-piece and the surface of a revolving armature should not be too slight; experience has determined that the increased efficiency is more than neutralized by the increased heating effect; the space is more valuable for keeping down the temperature of the conductor upon the armature, and lessening liability to damage resulting from a high rotative speed. Substantial bands should be also provided to guard against this latter.

It is of no little interest to note the changes marking the successive stages of development of any given machine, as showing the effect of experience upon the more theoretical considerations; and bearings may be taken upon these successive stages which may guide the close observer in the selection of his apparatus, or the designer in the future development of any special form of dynamo machine.

A beautiful analogy may be traced between the distribution of the potential in the ordinary electrical circuit, and that in what may be known as the "magnetic circuit" of a dynamo. In the first, the arrangement of the potential at various points depends upon the resistance encountered by the electric current at these points, varying in degree with the amount of such resistance. This law holds true also in the *magnetic* potential at various points in the magnetic circuit of the machine. Here, the points of greatest resistance occur at the space which is between the polar extension and the armature core, and the degree of magnetic potential required at this point to perform the necessary work will be determined by the distance between the magnetic surfaces at these points. For the *highest* economy in the field, therefore, this magnetic circuit should be closed, and no space whatever provided between said armature core and said polar extensions. This, of course, being impossible, the aim should be as near an approach as is practicable, for the reason that the cost of maintaining the magnetism of the field is a function of the degree of potential required at the pole-piece; and where this is low, only a small amount of current is required to maintain the field. In this case, a large iron core, with comparatively small amount of wire upon it, will suffice to do the work.

An erroneous idea, now going out of practice, has been to leave magnetic projections on the surface of the armature, which tend to short-circuit and satisfy the magnetic potential of the field without compelling the induction to take place directly through the armature coils. The importance of as nearly closed a magnetic circuit as possible was pointed out as early as 1878 by Lord Elphinstone, who at that time forecast the peculiarity which may now be seen as the result of practice and long experience in the art, viz., the distance separating the armature and field-magnet, the masses of metal, the efficiency at the field and general construction of the machine are determined by the *character of the current* to be developed; the greater number of convolutions and the greater thickness of insulation between all the parts of the armature-coil and its supporting core in case of *high-tension* currents requires a greater space for the coils, diminishing the size of the armature core and increasing its distance from the field. The magnetic potential of the latter being, therefore, greater, its mass is lessened in both the pole-piece and core; while a proportionately large amount of wire is required in the helices and corresponding increase of energy required to maintain the magnetic potential. This peculiarity and difference may be seen in the two classes of arc machines, belonging respectively to the so-called high-tension and low-tension system, and is even more readily apparent in the leading machines belonging to the two respective fields of electric lighting. This points to the fact that the internal efficiency of a machine varies with a certain function of the electromotive force of the current generated, being less for a high-tension machine and greater in a machine producing greater quantity and lower electromotive force.

In electric lighting there are many other features of vital importance aside from the mere electrical efficiency of the generator; for instance, the cost of construction of lines, the distance at which the various operated devices may be maintained with economy, the economy of transmitting the current on the exterior surface or lines, and, possibly, there also exists a difference in the transformation of electricity into light-energy, by the use of the voltaic arc; all points in favor of the high-tension system; While the cost of maintenance, liability to leakage and attendant expenses, especially on underground systems, the danger to life and property, and the economy of construction and facility in coupling, especially in the incandescent system, are decidedly in favor of the lower tension.

The preponderance of the advantages in either of these systems must depend entirely upon circumstances and upon the judgment of the investigator, no two plants being attended by exactly the same conditions.

The matters going to determine the *best form of dynamo*, as has been briefly pointed out, are so numerous, and the various forms of dynamos are best adapted each for its peculiar sphere, that a general formula, prescribing that form which is best in all cases, would be impossible. The art, however, has brought dynamo machinery, the construction of which at first was attended by so many difficulties of a highly scientific nature, down to a sufficiently practical basis, so that good judgment with regard to ordinary mechanisms of a higher order are relevant to the most salient features, and may be depended upon largely in guiding those interested in investigating this class of apparatus.

DISCUSSION.

Mr. Spang: I understood the gentleman to state that a dynamo would produce the best results by subjecting the armature to the greatest possible magnetic influence. I represent the Ball unipolar dynamo, and it may be well to give you a little history of this machine; one that has been ridiculed by the scientific world to a great extent; but which is now coming forward and being recognized as the dark horse in the electric field.

The President (Mr. J. Frank Morrison): I must call the gentleman to order. It is not in order for members to set forth the merits of their inventions. You will observe that while Mr. Sperry is the inventor of a machine, he has made no reference to any apparatus. If the gentleman desires the floor for anything else that affects the interest of electric lighting, we will be pleased to hear from him.

Mr. Spang: I wanted simply to make that point. Mr. Charles E. Ball of Philadelphia—by the way, he should not be confounded with C. M. Ball, of Troy, N. Y.—about five years ago Mr. C. E. Ball constructed a compound Gramme machine with two armatures, each under the inductive influence of two pole pieces. That machine gave four lights with a certain amount of power. By an accident one pole was left off on one occasion, and he found himself running five lights by one pole, and he took off another pole on the other, producing with about the same power six arc lights against four, giving rise to the Ball unipolar inductive dynamo. I might state that in order to determine the relative merits of dynamo machines it might be well for each party who has a dynamo to try and get it in practical operation on the New York Aqueduct. There they are obliged to run on an average fifteen and a half hours a day. I think if any one wants to determine the merits of his machine, that is the place to do it. There are now six machines there, and I think in a short time they will all know their merits. I believe there is a desire on the part of gentlemen connected with the electric lighting business to get at the best dynamo, and I think it would be a very good thing if the association would address a communication to the different electric light manufacturers suggesting that at some future time they produce and hand over to the association to be tested, dynamos, in order to determine their relative merits. The machine that I think ought to be made would be something that would meet the wants of the public. The wants of the public require a 5-ampère, a 10-ampère, a 15-ampère and a 50-ampère machine. There are so many parties in the field making assertions about what they have accomplished and what they will accomplish, that I think they ought to be put to the test, so that the electric lighting men might be able to distinguish between the real dynamo experts and the shysters and snides. I think they ought to be put on their mettle and made to show what they really can do, and if in order I would like to offer a resolution that the President of the Association be directed to address a communication to the different manufacturers to produce at some future time, say within a year or nine months a suitable number of dynamos, capable of producing not less than 30 arc lights. The reason I make the suggestion as to 30 arc lights is that almost anybody can build a five or ten-arc machine; but the trade is calling for a 30 and even up to 100-arc light dynamo, and I think it would be well to put each of the dynamo inventors on his mettle, and practically show which is the best dynamo in the market. There is another point; if in order, I would like to take a little exception to the statement made by Mr. Moses.

Mr. De Camp: The gentleman took exception to the statements made by Mr. Sperry, and now he is taking an exception to a statement made by Mr. Moses. I wish to suggest with regard to these exceptions that the remarks of the gentleman should be confined to giving an opposite view of the case. I see around me a number of gentlemen who I think are bristling for just such an argument as is invited by the gentleman now on the floor. We are limited now to 2 o'clock, as I understand it, and if too much time is taken up with these arguments we will not get through with our regular business.

Mr. Spang: These arguments, I think, will do more for the advancement of the Association than anything else. The members, I think, ought to be properly enlightened on these different subjects.

Mr. De Camp: We cannot be enlightened by gentlemen taking exception to the remarks of other gentlemen, and not answering them in any other way than by putting forth the merits of their own system, which is really the drift of what the gentleman who has the floor is saying.

The President: The point of order is well taken. The gentleman will confine himself to answering the arguments.

Mr. Spang: That is all I have to say at present.

Mr. F. J. Sprague: I quite agree with Mr. Sperry that all the parts of the armature should be under the inductive influence of the machine. I will call attention to the Edison machine. (The speaker made a sketch on the blackboard). Those armatures (indicating) are wound on a modification of the Siemens armature. The larger machines are wound with a single lap. Of course, on a machine of that kind it is necessary that the field shall be of the most powerful possible character, because the resistance of the armature, on account of the few number of turns, must be just as intense as possible. And as an example of how you can get at the field aside from mathematical determination, it is well to run such an armature in its field with no load whatsoever on it, taking the intensity of the current by an electrometer and then calculating the number of feet per second that the wire has to move to develop at its terminals an electric force of one volt. I believe that Mr. Moses G. Farmer was the first to suggest that method. Taking such a field as the Edison field, I want to get the number of feet per second which a wire has to move in order to develop one volt at its terminals. We take the number of blocks or sections n, in the commutator; the length of the field in inches (b), that is of the *active* part of the field, taking that (indicating) as the length of the field; multiply that by the diameter (d), in inches, of the armature; that by the revolutions r, and that by the number of laps of wire l. Then divide that by 2,750 multiplied by v, the number of volts, and it gives you the number of feet per second that the wire has to move to develop an electric force of one volt. In a private test we got a field so intense that the wire moved at velocity of 25, developing a force of one volt at its terminals. Here is the formula:

$$\frac{n \times b \times d \times r \times l}{2{,}750 \times v}$$

Mr. Sperry: I am very glad to have been substantiated. There is one point, however, that might be of interest to us all. It seems to me that in operating a machine, to get our money back, we have to operate practically. I do not care so much for the high scientific points as for the salient mechanical points. Now the actual difference with regard to the electromotive force developed per unit of peripheral velocity might be seen in this way: Take for instance a galvanometer (the speaker made a sketch on the blackboard), then let us take also a Siemens armature. In the older forms of Edison machines the length is greater as compared with the diameter. Now for practical operation, of course, a certain peripheral velocity must be obtained by the wire that develops the current, and the idea is to get as high peripheral velocity of the wire as is possible with as low an actual rotation as is possible; because one difficulty experienced by some builders in the Siemens armature is this: that when the armature is made large in its diameter in comparison with its length—so that with a small actual rotation a large peripheral velocity is obtained in the useful part of the conductor—one difficulty encountered there is that the useless part of the wire, represented from that to that and from that to that (indicating), is very large as compared with the useful portions of the convolutions. Now, when the armature is cut down in its diameter so that this relation will be large; that is, of the useful as compared with the idle wire, then to get that same peripheral velocity we will have to rotate the machine at a very much higher velocity, and of course there is the trouble with the waste of energy at the journal when we do that, so that the golden medium is to be found between the core of the diameter of the armature and the amount of efficient as compared with inefficient wire, which will also be a function of the rotative speed.

Of course, the matter that was brought up by our friend representing Mr. Ball is a matter that has been gone into by people who had better facilities, perhaps, than any of us here, and they have been published from time to time; and reference can be made, to save time, to those. Although, when I speak of the amount of conductor that is rendered efficient as compared with the amount that is idle, I had reference to this view of the machine; that is to the transverse section rather than the amount that is covered by the field, taking the other view.

Mr. Spang: I referred to the work on the Croton Aqueduct. There are five companies represented there—the Ball and four others. They said they were obliged to run about fifteen hours and a half a day. Two dropped out, and the other two are very anxious to get out. If you want to have your theory knocked higher than a kite, simply take your machines there. They all assert that the bipolar inductor machine is *the* machine; but you put it to the practical test six days and six nights as the unipolar machine has been tested, and it will knock it higher than a kite.

The speaker was called to order by several members.

The President: The gentleman will please take his seat.

Mr. Spang: Is my resolution in order that I suggested?

The President: Your resolution was to appoint a committee of three to address a communication to the companies asking them to make tests of their apparatus. The resolution is in order. The gentleman will please put it in writing.

Mr. Spang then prepared and read a resolution to that effect.

Gilman's Electrical Subway.

The electrical companies of New York having failed to lay before the Underground Wires Commission any plan of their own for putting the wires below the street surface, the duty of providing plans devolves upon the commission-

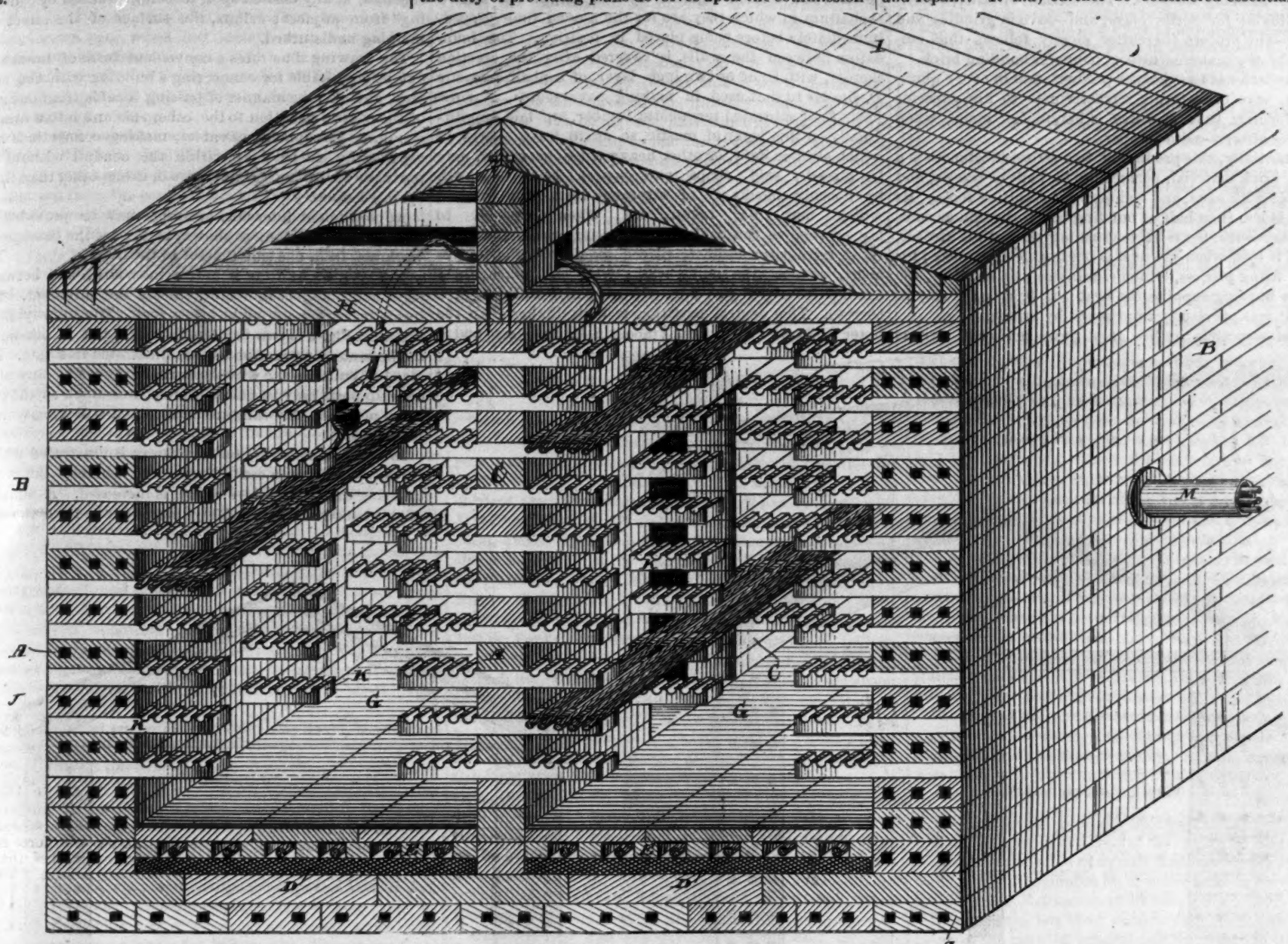


FIG. 1.—END VIEW, GILMAN ELECTRICAL SUBWAY.

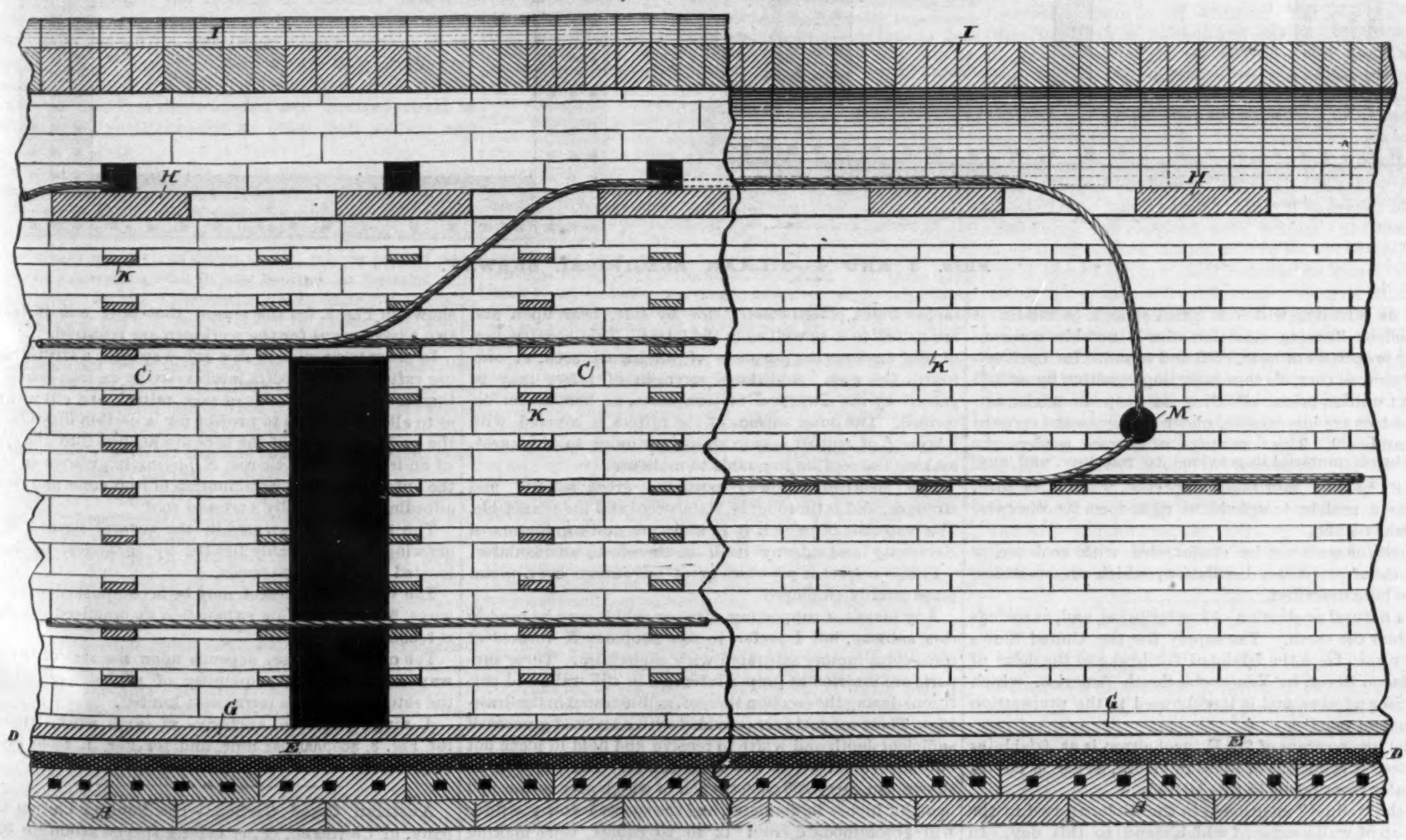


FIG. 2.—METHOD OF CONNECTION.

Mr. Spang: I suggest that the committee be appointed by the Association or by Cornell University. I think Cornell is now recognized as the leading electrical authority in the country.

A Member: Inasmuch as we cannot have time to build these machines before the next convention, I move that it be laid on the table, and action be taken on it at the next convention.

Mr. Spang: I think that is rather a cowardly way of disposing of it. Resolution adopted.

ers, who are now in receipt of propositions, advice and suggestions. We illustrate on this page and the next the Gilman Electrical Subway, submitted to the Commission by Mr. C. C. Gilman, President of the Gilman Porous Terra Cotta Company, Washington Building, this city. We give with the views the statement also submitted by him, as follows:

It may be considered as settled, that the wires of all telegraph, telephone and electric light companies are to be housed together in one or more underground conduits; that said wires will largely increase in number from year to year, and that facilities must be provided for laying and removing wires and cables, and for making connections and repairs. It may further be considered essential that the conduit be waterproof, strong, durable, and relatively cheap, and easily accessible at any and all points. The plan, herewith submitted, aims to accommodate all these demands, by employing in construction materials comparatively new, hitherto certainly so, in the combination given. These, in every detail, are "terra-cotta lumber" and mineral pitch, or asphaltum, and following is a brief description of either:

Terra-cotta lumber, a material of recent invention, and rapidly coming into use for fire-proofing purposes, is made under two formulas. The first involves the intimate mixture of sawdust with plastic porcelain clays, and a treatment in subsequent manipulation, commonly pursued by fire-clay workers. The second, or other, substitutes alluvial for fictile clays, and—save in grinding and mixing—the process thereafter closely follows that employed by the manufacturer of common building brick.

As the latter is the cheaper product, and in every qualification, save of extreme refractoriness to fire, superior to the former; to it reference is hereinafter made, when speaking of terra-cotta lumber.

Substantially, this product of two refuse substances is a porous brick material, permeable to nails or screws, and workable with saws, and common wood-cutting tools. Its weight is less than half of building brick, though, as compared therewith, the relative crushing strength is greater. Its cost is less, when sawdust is obtainable as a waste; for in the firing process, which eliminates the sawdust, the latter in burning supplies the heat for baking the clay in which it was previously imprisoned by mixing.

As indestructible by fire, frost, gases, acids and age, as bricks, its porosity, which is great enough to render it an excellent filtering material, affords notable non-conducting properties of heat, cold and sound. Its open cellular structure compels thorough impregnation by melted asphalt; unlike brick, affording so deep an anchorage that the two are inseparable, under the severest exposure to wet and cold. This exchange of service renders the porous brick material impervious to moisture, and augments its natural insulating properties, while it, in turn, serves as a matrix to uphold in rigid form its otherwise too pliant tenant.

Asphaltum must not be confounded with coal tar, or residuums of petroleum distillation, which are worthless for uses here described.

It is a natural production of low latitudes, and, as springs flows from the earth. The supply for the United States mostly comes from the Island of Trinidad and the delta of the Orinoco River, in Venezuela, South America, which the former adjoins, and is largely used in the preparation of pavement mastics.

At the temperature of 70° F., asphaltum is as friable as ice, indeed it is cut out of lakes in blocks, as ice is cut in the winter from ponds in this latitude.

It is the "slime" mentioned in the Bible, as used in the laying up of walls, some of which stand to this day. In the construction herein described, it serves not only as a stuffing for the porous brick material, but as the bond wherein the blocks are laid, as cement is used in masonry. It is worth in this market by the quantity from $20 to $28 per ton.

Referring to Fig. 1, the blocks *A* of terra-cotta lumber are made about twelve inches wide, from two to six inches thick, and from one to four feet in length, and receive their first coat of asphaltum at the factory before shipment. The foundation of the subway consists of two layers of blocks so saturated, and alternately laid lengthwise and crosswise, that joints may be broken as shown. On this foundation, the outer walls *B*, one foot in thickness, and the central six-inch partition *C*, are erected; the blocks being bonded together by the use of hot melted asphaltum in which they are for the second time dipped, immediately before being placed in position. The foundation between the walls, is covered after the erection thereof, with a one or two inch layer of asphaltic mastic *D*, similar to that used in making pavements. Narrow joists *E*, of saturated terra-cotta lumber, are laid longitudinally on this layer of mastic, so as to leave spaces, in which electric light, or other heavy wires or cables, may be placed; said strips and spaces being covered, by flooring blocks *G* of saturated terra-cotta lumber, which may be taken up when desired, to lay or remove the cables. Connecting girders, of saturated terra-cotta lumber, placed at desirable distances apart, connect the outer walls with, and brace them against the middle partition, and are nailed and cemented thereto. This central partition is built higher than the outer walls, and the rafters *I* (about 8 inches deep and 4 inches wide), placed closely side by side, bear upon and are nailed to it as well as to the latter. This construction of roof answers the purposes of an actual arch, at one-fourth the cost. Additional strength of rafter may be gained by the insertion of iron cores, as hereinafter described. The outer surface of the rafters is covered with a layer *L* of asphalt mastic an inch or more in thickness, making the roof impregnable to moisture.

This electrical subway possesses great solidity and strength, and is thoroughly waterproof and indestructible. The materials of which it is built are non-conductors of electricity and subway itself is, therefore, an insulator.

In this respect it possesses great advantage over metal pipes usually employed.

Any means of supporting wires or cables may be used in this subway, but I prefer to use supports *K* formed of terra-cotta lumber saturated with asphaltum. These supports are inserted at proper intervals in the walls and partitions during the erection thereof, as illustrated in the drawings. These supports are provided with a series of grooves of sufficient depth and width to receive and hold in place not only individual wires, but large cables. The supports as shown can carry 200 cables, each of which may be one and one-half inches in diameter, and the spaces below the floor will accommodate from 12 to 20 cables, thus making a total of about 220 cables. The capacity of the subway is, therefore, from 10,000 to 25,000 wires, depending upon the number of wires per cable.

At intervals as required, lateral tubes or conduits *M*, of the same material, extend from the subway either into conduits in cross-streets or into adjacent buildings. The cables or wires are passed into these lateral pipes or conduits, and the connections are made inside the buildings with the wires therein.

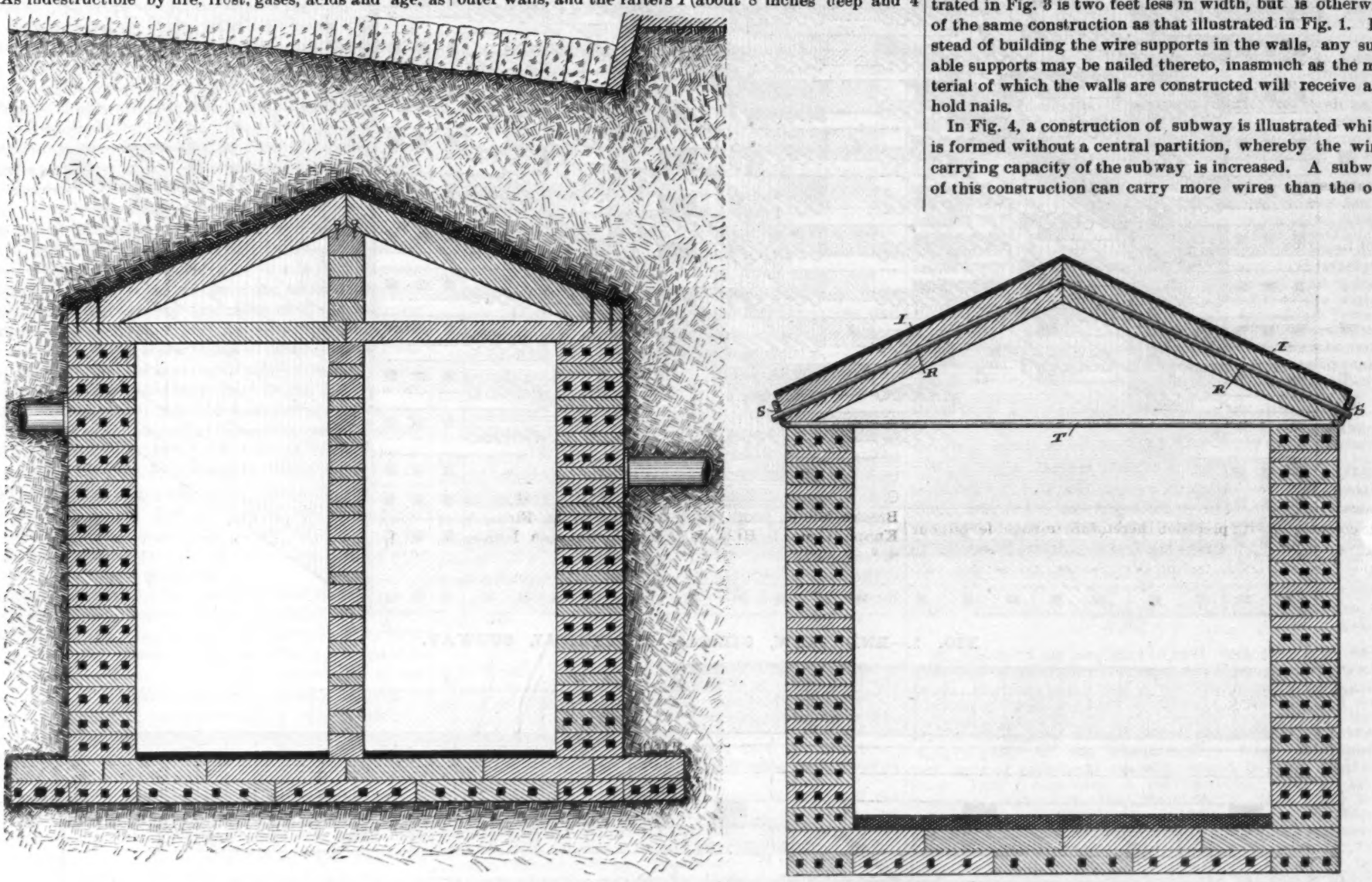
Lateral branches or conduits can be connected with the subway at any place and at any time, because the materials of which the walls are constructed can be bored and sawed with ordinary wood-working tools, so that an opening of the exact size can be quickly made and as quickly repaired, at any desired spot, it being reached by "drifting" from adjacent cellars, the surface of the street remaining undisturbed.

The drawing illustrates a convenient form of branch or extension suitable for connecting a building with the subway, and also the manner of passing a cable from one side of the central partition to the other side and into a branch conduit. The splicing of cables, making connections and repairs, can all be done within the conduit without removal or disturbance of any wire or cables other than those operated upon.

At convenient intervals, openings may be provided in the central partition, as shown, to permit the passage for workmen from one side thereof to the other.

In Fig. 1, the subway is 10 feet in width, and between eight and nine feet in height, outside measurement. The inside measurement, eight by six feet. The subway illustrated in Fig. 3 is two feet less in width, but is otherwise of the same construction as that illustrated in Fig. 1. Instead of building the wire supports in the walls, any suitable supports may be nailed thereto, inasmuch as the material of which the walls are constructed will receive and hold nails.

In Fig. 4, a construction of subway is illustrated which is formed without a central partition, whereby the wire-carrying capacity of the subway is increased. A subway of this construction can carry more wires than the one shown in Fig. 3, for the reason that only one instead of two passageways for the workmen are required.



FIGS. 3 AND 4.—GILMAN ELECTRICAL SUBWAY.

In order to provide such a sub-way with a strong roof, I use rafters of terra-cotta lumber having an iron core *R* cast therein. The outer ends of said rafters are cut away so as to allow said core to project for a certain distance, and the projecting ends of the core are hooked into the eyes *T* of an iron and steel tie rod *S* resting in grooves on top of the outer walls, this combination of iron cores and tie rods affording substantially a trussed roof.

The subways illustrated in the several figures of the drawings are preferably lighted by incandescent lamps, located at suitable intervals.

The ventilation thereof may be accomplished in various ways, but artificial air exhaustion as practiced in mining is recommended.

The cost, of course, depends upon the size of the subway adopted and the quantity of asphalt prescribed in the saturation of the terra-cotta lumber.

A rough estimate, exclusive of earth work, would be for Fig. 3, $65,000 per mile, and for Fig. 1, from $95,000 to $105,000.

Austrian Cored Carbon.—The Boulton Carbon Company, of Cleveland, O., is calling special attention to the above carbon, for which it has the exclusive agency for America. These carbons are very desirable for lighting assembly chambers, accountants' offices, and all in-door rooms where absolute freedom from noise is necessary. There is neither hissing nor sputtering. They are sold in pairs, the upper or positive carbon being 12 inches long, and the lower or negative carbon 7 inches long. While they do not burn so long as the Boulton carbon, they possess many special features of excellence.

The Claims of the Military Telegraphers.*

BY W. R. PLUM.

Of the say 1,150 operators engaged in and surviving the service, notwithstanding the remarkable facilities we have enjoyed for keeping track of one another, and nine years' effort to find our comrades, we do not now know that four years ago, when our society was organized, there were over 450 alive.

Quite a number of living comrades are known to be absolutely dependent and helpless by reason of their sufferings in the service.

One of our number who remained at his office in Winchester, Virginia, until the retreating Federals had nearly all left, was himself about quitting, when he received a telegram from the commander for Harper's Ferry calling for reinforcements. His stay to transmit that dispatch resulted in his capture and imprisonment in Libby prison. For years he has been suffering from the effects of his imprisonment, and is in daily fear of the third stroke of paralysis. Long dependence has made him poor indeed, and now his only hope is in a pension.

Another from the Department of the Gulf, whose horse during the siege of Port Hudson was twice shot under him, and whose field office was just behind an Indiana battery, where for many hours he was under fire from the enemy's guns, has for years been unable to support his family at his former business, though he was an expert, and is now struggling on a far Western farm, under discouraging physical and consequent financial troubles.

These few examples, taken from different military departments, illustrate the sufferings of living comrades, which our government has permitted to continue for twenty years without relief, notwithstanding the service of the army operator was so important that nearly every telegrapher found in the ranks was furloughed to serve out his time in our corps. Thus, during the war, not less than 175 soldier operators were required to turn over their arms to manipulate the Morse key, and the War Secretary issued a general order exempting telegraphers from conscription. Of the captured operators nearly one-third are dead.

The fact that our military service was novel, has worked against us.

Since we set the example on a comprehensive scale, military telegraphy has, in all Europe, become strictly army telegraphy. For four years we demonstrated to Europeans how armies should move on telegraphic orders and made to co-operate, with precision theretofore impossible; but our government did not take the first step deemed essential to the Europeans, viz.; technically to merge the service into the army system. General Sherman has written that we "were as much a part of the army as though armed with muskets in the ranks; for before the discovery of the magnetic telegraph, the sending of messages back and forth, to and fro, was always done by armed cavalry messengers and escorts, consuming a large portion of the active army. In fact, there should have been, in the civil war, a regular corps of telegraph operators, with regular muster rolls, so that the wounded and disabled could be entitled to the same pensions as other staff soldiers and officers."

In case of another war, it is probable that General Sherman's views will be concurred in.

It is gratifying to report that though occasional rumors of opposition to our bill, on the part of Congressmen, came to me, every member, of either house, whose name I ever heard in connection with it, has favored its passage, and Mr. Murray, of the Committee on Military Affairs, who had charge of the bill, had no doubt of success, if a vote could have been reached.

Testimonials from many of our greatest commanders have been received, substantiating in varied language the statement of General Banks, that "the military telegraph was, in truth, an electric nerve that united the armies, consolidated their powers, inspired them with courage and hope, and, finally, led them to victory."

Except ours, it is believed no war ever took place where 6,500,000 messages were transmitted by any means, yet that number was actually telegraphed by us. During one year our corps (linemen included), numbering not to exceed a monthly average of 1,100 persons, all told, operated 8,622½ miles of military telegraph, and sent over 2,000,000 telegrams.

Of the millions of dispatches sent, those most important were "put up" in cipher by the operator, who alone of all persons connected with the army, or War Department, held the keys. It is not possible to exaggerate the trust thus reposed in the army cryptographer; and in no case was he recreant thereto, yet he held secrets that might have enabled him to dismember a nation.

Operators always accompanied the armies in the field, and even on important raiding expeditions, some of which owed much of their success to information tapped from the enemy's lines, or false telegrams transmitted by us.

I wish to quote from General Stager's annual report to the Secretary of War for 1863:

"Follow the army where you will, there you will find the telegraph exercising its vigilance and its protection over the surrounding camps. At the foremost picket posts, in the rifle pits and in the advanced parallels, at any hour of the day or of the night, you can listen to the mysterious yet intellectual click of the telegraph instrument; amidst the strife of battle and the whistling of bullets, its swift, silent messengers pass unseen and unharmed. It is through the medium of the telegraph that the vast amount of supplies of various descriptions required for the daily sustenance of the armies are ordered forward from their depositories. If an advance is to be made, all deficiencies to the comfort and necessities of the troops or any lack of the material of war can, by the assistance of the military wires, be speedily procured. If a retrograde movement is contemplated, all detachments adjacent to the line of march are quickly notified by telegraph, and the whole column is in motion at once. The public mind has but a faint conception of the magnitude of the uses of the army telegraph."

If these things scarce hinted at, so meagre of necessity here is my statement, do not show military service, we have risked much to little purpose; if they do evidence such employment, we are entitled to all the recognition according to our responsibilities and service which would have been accorded us had we not been pioneers in a new department in war.

* Abstract of address before the Military Telegraph Corps Association, August 19, 1885.

The Meeting of the Old-Timers.

The following are the names of those who were elected members of the Old-Time Telegraphers' Association at the recent meeting in this city, August 20: W. P. Phillips, R. W. Martin, Orin Waddell, A. L. Suesman, Wm. D. Sargent, Geo. Farnsworth, C. S. Thompson, Gerritt Smith, J. E. Fenn, Geo. A. Hamilton, O. W. Stager, Henry Fairchild, Dexter Hubbard, Stephen C. Mason, R. B. Gemmell, Uriah B. Wilson, H. B. Chamberlain, J. H. Nichols, E. Schermerhorn, Henry A. Reed, W. M. Woodruff, A. S. Brown, D. H. Bates, W. H. Young, D. J. Ludwig, W. E. Huntington, Richmond Smith, Charles T. Smith, Robert Tomes, Paul C. Havens, R. J. Hutchinson, H. W. Gilbert, T. P. Scully, H. Holland, J. L. Edwards, J. W. Woods, L. S. Jones, T. B. Fullon, A. R. Brewer, R. G. Stephenson, J. Knittle, W. L. Ives, C. J. Brown, A. J. Long, Frank B. Knight, J. Rathbone, T. Finnegan, John Brant, E. M. Tomlinson, F. W. Royce, J. H. Emerick, J. Soule, C. E. McCluer, E. A. Leslie, James Brown, M. H. Redding, J. I. Gilmore, John W. Parsons, D. T. Murray, J. S. Scobell, C. A. Clute, Wm. O. Shelly, A. G. Safford, Geo. M. Lyons, C. D. Hammond, Robert B. Lines, J. B. Yeakle, David Brooks, Lee N. Booth, S. A. Duncan, D. H. Fitch, S. B. Knapp, Lester S. Hills, J. P. Merrill, Kenneth McKenzie, S. S. Bogart.

The address of the President, Mr. Hammond, was as follows:

Gentlemen of the Old-Timers Association: In performing the official duty of announcing the formal opening of this meeting, I cannot refrain from expressing how strongly I am impressed with the continually increasing significance of our association. It brings us face to face with a myriad of long-slumbering early dream-fancies, hopes, ambitions, disappointments—all that went to make up the sum of our existence in the stormy, busy period of our youth. It brings back with wonderful clearness our first startling conceptions of the telegraph—the awe we felt in first opening and closing a key—the wonder why the local and the relay would not give a partial sign of action as we slowly diminished the distance between the points, but would only respond at the instant of actual contact; the glimpse and budding impression of that awful mystery surrounding the cause and nature of the electrical current, which the subtlest intellect never has penetrated, and never can penetrate; the fresh perfume of our first reverence for the Superintendent. All these come back to us, in these meetings, as scenes of our childhood are brought back to memory by the words of or air of an old song, or the odor of a flower that grew in our mother's garden.

Is it strange, then, that, as I stand before not only the companions of my life's occupation, but even among some whose names are linked with my earliest notions of official reverence, there should come upon me a deep sense of the honor conferred by your appointment, as well as the diffident respect felt by the grown-up pupil when standing before his old master. It can be no inadequate illustration of the significance of this association to mark the fact that, notwithstanding the immense and almost boundless development of the telegraph to-day, we are associated in this meeting with him who first in all the world was a telegraph superintendent. With feelings of anxiety for the perpetuation of our association, let me urge upon you these old claims of kindred experience, and beg that they may not be forgotten hereafter. Let me hope that our remembrance of each other may not be allowed to flag and die out. The mighty, the great, and the rich may command the present and the future, but only our own negligence and carelessness can take from us our past.

Permit me to ask your consideration of some plan by which a depository may be established for such relics of our early telegraph practice as may yet be in existence. As has often before been suggested, the announcement of a place for the safe keeping of such mementoes would bring to light many relics now unknown, and surely there could be no question as to the value of such a museum to such an association as this.

To-day, as we renew our reminiscences, recalling the strange, crowded events of telegraphic history that are thronging upon our memories, should we not give a thought to the telegraphers of the present, and their hope and promise for the future?

Are we near enough to them? We are surely concerned in the achievements and prospects of those who are to carry forward the occupation of our youthful days. We have more than a careless interest in the multitudes of operators that have sprung up, to daze our elder heads with their marvelous performances and intentions. What is their present state? What is to be their destiny in life? Can we, by sometimes giving them a word of warning or encouragement, in any way help to raise them to a higher level? The development of telegraphy will take care of itself. We need not be troubled about the uses, devices or discoveries pertaining to our art. But the operators, the persons, the fellow human beings, that are swarming behind us, heated with all the faults, follies and temptations that clung to our own youthful skirts—how is it with them? Independently of the condition of telegraphy itself, will it not be a pride and a joy in our approaching old age to see them rising in the scale of human life? We don't care about their skill—they cannot possibly be worse plugs than we were; but it would be pleasant to know that they are to be better men than we are.

Since our last meeting some of our associates have solved the great mystery, and sunk forever from our sight, to emerge only upon the other shore. And as we irresistibly advance toward that time when all association is ended, the ties that bind us grow more precious, we turn oftener and more eagerly to each other for the answering glance of recognition and the cheering words of greeting; we listen more intently for each other's "calls"; we answer them more promptly. To-day we shall bear tributes to the memory of those who have left us. May we that remain be drawn closer together in the bonds of our Old-Time remembrances!

At the adjourned meeting on the boat, Mr. Hammond suggested that something should be done to perpetuate the association, and he moved that candidates for membership be eligible if they entered the service twenty years before their application, instead of in 1863. After much discussion, the constitution was amended by a two-thirds vote to the above effect.

Mr. Tomlinson presented the following resolution, which was adopted: That the Secretary of the Old-Time Telegraphers' Association shall request each member to give in his own handwriting his personal recollections from the time he first entered the service, those papers to form part of the history of the organization.

A committee of three was appointed to devise ways and means for extending relief to indigent Old-Timers in such a manner that it will not take too much the form of charity. Mr. Bunnell, Colonel Gilmore and Mr. Dealy were named as the committee.

An addition was made to the constitution providing that a standing committee be appointed to pass upon the eligibility of those making application for membership.

The sum of $25 was donated by the treasury toward the expenses of erecting a monument over the remains of James Leonard at Frankfort, Ky.

Philadelphia's Electric Railway.

The American Electric Railway Company, which is commencing an experimental line on Ridge avenue, Philadelphia, is the same company that, then called the Bidwell Company, operated an experimental car and track at the Electrical Exhibition in Philadelphia.

Ridge avenue has been chosen for the experiment because of the peculiar grades, and in order to exhibit the superiority of the new motor over horse-power in surmounting them in all weather. The company is commencing work on its shop and engine-house. It is the intention to provide one car with a motor at first, so that its running will not interfere with the trips of the regular cars of the line. The conduit will be laid so as to avoid interference with the travel of horses, and the tracks will not be disturbed.

In shape the conduit will somewhat resemble those laid by the Traction Company, but will be of heavy timber, instead of iron, below ground. It will be braced inside with iron knees, and provided with drainage facilities. Running along beneath the top will be the compound conductor of copper and iron, half circular in shape, well insulated, and protected from damage from outside influences. On the top of the conduit forming each side of the slot, which will have a half-inch opening, will be iron plates about five inches in breadth altogether. This slot opening will not be directly in the centre of the track, but to one side of the meridian line. The current will be transmitted by an ingenious contrivance from the conductor underground to the motor in the car, and will be under instant control of the driver or engineer. At intervals of eighteen feet plates will be arranged over the conduit which may be readily removed for repairs and other work, and without removing the body of the conductor. The bottom of the conduit will be cemented previous to filling in the ground about it.

An Episode in Cyrus Field's Career.

The dinner given by Cyrus Field recently in London has stimulated a Secret Service Agent in Philadelphia to talk about an occasion when he arrested Cyrus Field on suspicion of being a counterfeiter. It was in 1855. Uncle Cyrus was crossing the Delaware River in a ferry-boat carrying a hand satchel, and the minion of the law "pulled him in" on his general appearance. "I went up to the young man," says the agent, "and tapping him on the shoulder, said, 'Please open that bag and let me look inside of it.' 'There is no objection to that,' was the reply; 'but who do you think I am, and who are you?' 'Well,' said I, 'I am a government officer, and I think you have something in that bag which is unlawful.' 'What's that?' he asked. 'Counterfeit money," said I, looking him straight in the eye.

"'Well,' answered the young man, 'I'll show you that you are mistaken,' and opening the bag he displayed several sections of twisted wire. 'My name is Cyrus W.

Field,' he said, 'and I've just come from Washington. I am now going to New York. This wire is a sample of the ocean cable, which I have been showing in Washington.'

"He never got the least bit angry, but smiled again and seemed to take the whole thing as a joke. I often wondered whether he remembered the incident."

Facilities for Inventors.

To the Editor of The Electrical World:

SIR: I notice that the London School of Electrical Engineering makes the following offer to inventors: "Inventors provided with every facility and the use of all necessary plant and machinery for testing or working out electrical inventions and improvements of every description. The utmost secrecy guaranteed and advice given as to commercial value of new inventions. Private rooms and high professional assistance if required." Is there any school in this country which offers such facilities? I am aware that there are places where one can get work done, at high prices, exposed to crowds of students and visitors, as he could in any machine shop, but I do not know of any such facilities as those above offered. There certainly should be, however, in this home of inventors, with its boasted superiority to other lands. C. E. F.

NEW YORK, Aug. 18, 1885.

Lighting by Primary Batteries.

To the Editor of The Electrical World:

SIR: There appears in your issue of August 15 a letter from Mr. James F. Kelly, calling into question the adequacy of the test put upon the Kauffer-Goldner battery to verify the claims of the inventors, described in your issue of August 1. We take the opportunity to explain what a little consideration should make clear. In the first place, we had already obtained ample evidence of the efficiency of the battery for continuous work, having run the lights five or six hours a day during a period of six weeks, including two runs of sixteen hours without intermission, and this with a single charging of the battery. It was then desired by the parties making the test to measure for themselves the duration of light obtainable from one charge of material, and for the purpose, as clearly expressed in the passage quoted by your correspondent, the test referred to was devised.

In view of the fuller description given in the issue of THE ELECTRICAL WORLD of August 15, we do not think Mr. Kelly will deny that the test established what was claimed upon this point. Quite another matter, although one of equal importance, is what we may call the sustaining power of the battery. Knowing well that it was capable of working consecutively during periods of five or six hours, and longer, the inventors considered the test, six minutes on and six minutes off for a period of 152 hours, as harder than to run 4 hours out of 24 for 38 days. It would seem that at the end of 24 hours, after having worked 12 hours and rested, so to speak, 12, the battery would be in poorer condition to begin the second period of 24 hours than after working 4 hours and resting 20, and this for the reason that diffusion—upon which depends the supply of depolarizer and removal of waste—is, as is well known, a slow process. We have been unable to find any experiments bearing directly upon this point, and if Mr. Kelly can offer any evidence against our view of the matter we shall be glad to be informed. What we have said about our battery is certainly very different from saying, as Mr. Kelly charges, that a battery that will work well on open circuit, will work well on closed circuit. We agree with him that the best test is actual work in the conditions of practice, and by such tests we have already shown the efficiency of our battery.

KAUFFER & GOLDNER.

BOSTON, Aug. 15, 1885.

The Telephone in Venezuela.

The returns from Venezuela just received by the Inter-Continental Telephone Company show that the result of the business for the quarter ending June 30, 1885, was:

From rentals of subscribers at Caracas, La Guayra, Valencia and Porto Cabello	7,880.91
From trunk lines between the cities	3,172.50
Total gross	$11,053.41
Expenses same period	4,616.77
Net profits	$6,436.64
As against net profits for the first quarter of this year	$5,232.59
Gain	$1,204.05

"More Light!"—In the course of a recent paper on distributing light and heat and supplying heated air to ordinary gas burners, Mr. Frederick Siemens, brother of the late Sir W. Siemens, expressed his opinion that the influence of electric lighting upon gas lighting had been very great. People had been accustomed, at exhibitions and elsewhere, to brilliant illuminations from single sources of light, and had called upon gas engineers to produce similar effects. The requirements of practical illumination had increased by degrees to such an extent that it was impossible to foresee at present where and how this general tendency would end.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Aug. 27, 1885.

Permission has been obtained from President Richards, of the Metropolitan Railroad, and from the Aldermen of this city, by the Knight-Bentley Electric Motor Company, to make a test of the motor on Huntington avenue. In East Cleveland, O., the system is said (see THE ELECTRICAL WORLD, Aug. 8) to have worked to the complete satisfaction of the railroad corporation and the public. It is even stated that in winter no horses are required to clear the tracks of snow, a plow being attached to each car.

Important experiments were made on Wednesday evening, the 19th instant, at the torpedo station at Newport, R. I., with a new arc search light, which is to be used at sea as the head-light, and can be put to port or starboard at will. The mechanical portion is operated now by electricity as well as the light. The specimen exhibited, on the night referred to, and experimented with, was of 15,000 c. p. It was thrown seaward, and the smallest boat or vessel was clearly seen at the most remote points. Then the light was turned toward the inner harbor, and almost the entire breadth and length of that sheet of water, together with the wharves of the city, were shown up clearly to view, the most minute object being easily discerned. Several officers of the torpedo station superintended the experiments, which were pronounced most successful.

The Pidgin Electric Calculating Machine Company have taken offices at No. 54 Devonshire street, and are taking steps toward bringing their ingenious little apparatus before the notice of State authorities and the heads of municipal governments throughout this country and abroad. This invention was brought to light by Mr. Chas. F. Pidgin, formerly chief clerk of the Bureau of Statistics of Labor of the State of Massachusetts, and now in charge of a force of over sixty clerks engaged in tabulating the Massachusetts Census and Industrial Statistics of 1885. Mr. Pidgin's Electric Calculating Machine has assisted its inventor in largely diminishing the enormous labor usually involved in the tabulation and proper grouping of the statistics. Those desiring full particulars regarding the machine should address Winthrop M. B. Hammond, General Manager of the company, No. 54 Devonshire street, Boston, Mass.

The Shipman Engine Company, No. 55 Franklin street, is busy manufacturing a two h. p. kerosene automatic high-speed engine of the kind illustrated and described in your issue of August 22. It is claimed to be especially suited for isolated domestic electric lighting. In a recent test made with this engine in running a ten-light 16 c. p. dynamo, the engine and incandescent lights were in operation for several hours with unvarying steadiness of speed and perfect evenness of light respectively.

The company expects to have running in its show room, at above address, on or about September 1, a ten light 16 c. p. dynamo, with wiring and lamps complete; which will enable the merits of the engine to be practically demonstrated to visitors.

The Edison Company for isolated lighting has closed a contract for 200 incandescent lights with the Medford Carpet Company, formerly of Medford, now at Malden, Mass.

Mr. Frank A. Osborne has just been appointed Manager of the Baltimore & Ohio Telegraph Co.'s office at Providence, R. I. Mr. Osborne has been connected with the Western Union for several years past, and was considered by the officers of that company as one of the most competent and reliable telegraphers in their employ.

All trains on the Concord & Portsmouth Railroad have been equipped with the Judkins Railway Train Signal, and the device is working, it is said, to the entire satisfaction of the officials of that railway. Work has already been begun by the Judkins Company in applying their apparatus to the through trains between Boston and Montreal. This includes the placing of the equipment on cars of the following railways, viz.: the Concord Railroad, the White Mountain and Northern Division of the Boston & Lowell Railroad, the Passumpsic Railroad, and the Southeastern Railroad.

The Thomson-Houston Electric Company is continuing to increase the number of its arc light plants, and adding constantly to the number of lights in plants heretofore installed in various parts of this country and abroad. One new piece of work has been the increase of their plant at Providence, R. I., due to the activity and good judgment of the officers of the Narragansett Electric Light Company of that city, who have induced their fellow-citizens to increase the number of the arc lights required there from 200 to 470. At New Milford, Conn., the company has just installed a plant of 40 arc lights.

At Salem, Mass., the plant has grown from 81 to 111 lights.

At Cleveland, Ohio, 60 lights have been added, making a total of 180 arc lights in the plant in that city. There has also been an increase of 30 lights recently at the plant in Terre Haute, Ind.

The Thomson-Houston International Electric Company has made a contract for furnishing a large electric light plant, combining arc and incandescent lights for the city of Guayaquil, Ecuador, where a local company has been formed, comprising prominent merchants in that place. The city has agreed to adopt the system permanently for street lighting purposes, and the present plant will be increased as rapidly as possible. The entire city will require about 150 arc lights, besides a large installation of incandescents, which have already been ordered.

Messrs. W. L. Libbey & Son, proprietors of the New England glass works, are about issuing their new catalgue showing all the various shapes, sizes and patterns of their arc globes and incandescent globes and shades. The catalogue is gotten up in splendid form, giving an elaborate display of their plain and decorated glass goods for electric light purposes, tastefully arranged under various headings. The publication is 11 × 13½ inches and is of the best materials. the illustrations of both globes and shades showing up distinctly, especially the latter which have decorations and fancy figure work. A special feature of their new incandescent shades, as shown in the catalogue, is the artistic and elaborate decoration on the inside of the shades, representing clusters of fruit, flowers, vines and shrubs, or portraying with striking effect beautiful landscapes, hunting scenes and other interesting subjects. Every electric light company should have one of these catalogues, and a line to Messrs. W. L. Libbey & Son, Cambridge, Mass., will insure to the writer the receipt of one by return mail.

It is rumored that a new company will soon be formed in this city for the purpose of aiding inventors in the electrical line.

The Electrical Development and Manufacturing Company reports a heavy demand for its pneumatic call bells, which were recently put in the market. This apparatus is perfectly noiseless, has no wheels or springs, or parts liable to get out of adjustment. They are also self-indicating, giving visual notice when the apparatus has done its duty. For hospitals, sick rooms or any place where quiet is desired, these call bells are specially suited.

Messrs. Blodgett Bros. & Co., 63 Kilby street, are making a new gravity drop annunciator, several of which are being put into public use. Among the installations of it may be mentioned that which was recently made in the Massasoit House, at Springfield, Mass. Where these annunciators have been used they have given satisfaction in every respect. The firm have numerous orders already on hand, and they are anticipating a large demand for same.

Mr. Frank Ridlon, the New England agent of the Brush-Swann Electric Light Company, has had his attention called to the fact that a number of daily newspapers have his name Ridlow, instead of Ridlon. He desires the correction made.

The Electrical Development and Manufacturing Company has just gotten up an improvement in mechanical call boxes for district messenger service. It is said to be more simple than call boxes now in use, as it has only two wheels, the other having four and upwards. It is claimed that this improved apparatus requires only one quarter the power generally used to ring it; gives a sharp, clear signal, and is arranged to leave the circuit open.

The Brush-Swan and Edison systems of incandescent lighting are being rapidly pushed throughout the New England States, and wherever installed are giving entire satisfaction.

Mr. J. M. Oram is making an improvement in the automatic internal arrangement of his time indicator. By a slight change in the position of some of the springs, the entire apparatus is made thoroughly reliable in its movements, and cannot err in designating the time. Mr. Oram's system of indicating time, through the telephone, is already familiar to most of the readers of THE ELECTRICAL WORLD.

PROVIDENCE, Aug. 26, 1885.

Business continues good with the leading engine manufacturers of this city, particularly with those who make engines which are specially adapted for electric lighting. In a recent interview between Col. Gardiner C. Sims and your correspondent, it was learned that the demand continues unabated for the engines of the Armington & Sims Company. In fact, the company are thirty-five engines now behind orders, with five just ready for shipment, as follows: One for the new Opera House, Chicago; one for the U. S. Electric Light Company, St. Louis; one for the Edison plant, St. Louis; one for an electric light plant in Detroit; and one for another plant in Minnesota. Among the engines in progress at the present time, are two that are very large and powerful for the steamers Dean Richmond and Drew, of the People's Line of steamers, New York; three of most beautiful and highly finished workmanship for the Italian navy; three of the best manufacture and finish for the Peruvian Government; one showing the highest grade of artistic workmanship, for the Milan (Italy) Opera House; one, the picture of symmetry and power combined, for the Interior Department at Washington; and two of 150 horse-power, and one of 200 horse-power, for cotton mills in New England.

The Armington & Sims Engine Company have done a great deal of business with the United States Government, and their export trade during the past five or six years has been very large. All this is owing to the excellence and durability of their engines. One of the principal and praiseworthy features of their manufactures, and which has contributed largely to the popularity and success thereof, is the solid steel shaft of one piece which forms an important part of all their engines. This is covered by a patent, and is their exclusive property; and hence they are the only engine manufacturers making shafts in one piece. Messrs. Armington & Sims have in their employ at the present time more than 100 men, most of whom have worked for them several years. There is not a man in their works who is not thoroughly experienced in the manufacture of steam engines, and familiar with every little detail connected therewith.

There is a peculiar air of discipline and system about the various departments, all of which bear evidence to good management; and the activity and bustle manifesting itself in every room and corner of the works is substantial proof that the facilities of Armington & Sims are being taxed to their full extent.

An idea has been prevalent that this company manufacture only high-speed engines. This is a mistake, as they make a variety of slow-speed engines for purposes other than electrical, and these embody all the perfections of engines of the high-speed type. The rapidly growing business of the Armington & Sims Engine Company demands the extension and enlarging of their works at an early day, and an increase in their present facilities.

Business is good with the Providence Electric Supply Company, manufacturers and dealers in electrical goods, No. 56 Washington street. Mr. C. H. Douglas, manager of the company, reports a steady increase in the number of patrons and the volume of business. The aim of this young and enterprising concern is to keep in stock only the best grades of goods in the electrical line, and its salesrooms are stocked with all the latest and most improved electrical apparatus of every description.

The New England Butt Company is making a new machine for winding fine wire, and also heavy machines for covering electric light wire. This company has been fairly busy during the past year; and taking the dull times into consideration, those interested in the concern have good reason to congratulate themselves on being able to keep their force of 170 men busy, and their works running full time.

The Carhart cable clip, manufactured by Mr. E. M. Carhart, No. 18 Custom House street, this city, is already finding a very extensive sale throughout New England. It is made to fit any size cable, and possesses the requisites of strength and durability. The device is simple, easily adjusted, and will not unhook or get out of place.

Mr. Eugene F. Phillips, President of the American Electrical Works, returned to the city on Monday evening last,

after a short vacation in one of the neighboring sea-side resorts.

Mr. Phillips is determined to make the clambake of this year the most successful and enjoyable of the series of social and recreative gatherings given under the auspices of his company.

The Narragansett Electric Light Company is enlarging its facilities for the purpose of extending and enlarging its system in this city. Two additional engines of the Armington & Sims make 60 and 90 horse-power respectively, and two new boilers of 150 horse-power each, made by the Jarvis Engineering Co., have just been placed in the central station plant of this company, which is also now engaged wiring for incandescent lighting of the offices of the Providence *Journal*. The number of lights is to be 150, and they will be started about September 10th.

Mr. Wm. A. Harris is taking his vacation for the summer at Block Island, and does not expect to return to his works before Sept. 1.

The Narragansett Machine Company in this city are making a serviceable and low-priced screw-cutting lathe, designed to meet the requirements of electrical, amateur or other light work, and possessing the important requisites—ease of operation, variation of speed, simplicity, durability and efficiency.

The Holmes Burglar Alarm system, which is being extensively used in the banks and business houses of this city, is, from all reports, giving general satisfaction.

The Rhode Island Telephone and Electric Company reports a very large and rapidly increasing demand for its new battery, the "Little Giant." The company is in receipt of numerous letters from prominent dealers in electrical goods in all parts of the country, speaking in high terms of this battery and substantiating their views by ordering additional quantities of it.

At the American Electrical Works business is reported as very fair indeed for this season of the year. The recent installing of so many new plants throughout New England has brought in a heavy demand for patent finished insulated electric wires, etc., etc.

BRIDGEPORT, Conn., Aug. 25, 1885.

A consolidation has taken place between the Brush-Swan and Bridgeport Electric Light Companies, which will, no doubt, result to the benefit of both those companies and of their respective patrons.

Messrs. Hoggson & Pollard, manufacturing electricians, whose office is under the Atlantic Hotel, in this city, are placing on the market an electric bell, which, with apparatus complete, under a guarantee of one year, they are selling at an extremely low price.

NEW HAVEN, Conn., Aug. 24, 1885.

The New Haven Electric Light Company feels very much encouraged over the success of the system it is using, and at the steady increase of its business. At present it has 175 arc lights (including 35 divided arc) lights); the number used by the city being 43. The system is the Thomson-Houston and the dynamos are run by four 50 horse-power Armington & Sims engines. This company has recently strung several miles of additional wire in order to accommodate the business men with more lamps, the demand for commercial electric lighting being on the increase. The company has been very much encouraged from the day it started up its dynamos by the hearty co-operation on the part of the city authorities and business men of New Haven. The officers of the company are: President, F. A. Gilbert; Secretary and Treasurer, James English. The plant and office of the company are at Nos. 86 to 90 Temple street.

Mr. Paul Roessler, No. 71 Church street, who for many years past has given special attention to electrical novelties and telegraph instruments, is at the present time in Europe. On his return he will bring with him many new and ingenious articles in the electrical line.

The Connecticut District Telegraph and Electric Company has opened a branch office at No. 813 Chapel street.

The office of the United States Telephone Company, of Connecticut, at No. 33 Centre street, has been closed for some time.

THE TELEGRAPH.

The Busy B. & O.—The Baltimore & Ohio Telegraph Company has contracted for the extension of its line a distance of about one hundred miles into the State of Arkansas to Little Rock and Hot Springs. The work is to be completed in one month. President Bates states that on Monday, the 17th, his company transmitted 20,000 messages from New York, the largest day's business it ever did here.

The Telegraph Conference.—The Berlin telegraph conference has approved of a proposal embodying a modification of the Bismarck proposal which was rejected the other day. The latter called for a uniform rate of 4 or 5 cents per word for telegraph messages sent to and from places within Europe. The proposition now approved is for a uniform tariff on telegrams between terminal points which are in Europe and on telegrams in transit in Europe to and from points outside, but at rates considerably higher than those advocated by the German Chancellor. Germany's efforts, however, to have the cable tariff to and from countries beyond Europe, especially to India, China and Australia, materially reduced from the present high rates, are likely to prove successful. The modified tariff is 10 centimes per word in large States and 6½ centimes per word in minor States.

The Buell Company's Plans.—Jose F. de Navarro, Robert Bliss, Narcise Villaverde, John J. McCook and James Clyne are the corporators of the Buell Electric and Pneumatic Company, which has filed its certificate of incorporation in the office of the County Clerk, New York. Its objects are to purchase, lease and acquire patents for mechanical and other inventions to be granted by any government, and especially for patents appertaining to inventions and improvements for electrical and pneumatic purposes, and for the use and application of electricity or compressed air, or both, as a means of heating, refrigeration, propulsion, locomotion or transportation, and the transfer, movement, distribution and regulation of heat, cold, light, force or power, by means of mechanical and other appliances, and the manufacture of such machinery. The capital stock of the company is $10,000, divided into 1,000 shares at $10 each.

THE TELEPHONE.

Dealing with Great Problems.—It is reported that Prof. A. G. Bell is at work on the photophone and the conversion of heat directly into electricity.

Destructive Fire.—A fire on the 20th inst. in the Bell Telephone Company's works, on Craig street, Montreal, worked up through the premises of the bank note company, causing a damage estimated at $80,000.

Private Lines in New England.—Complaint is made by the owners of private telephone lines around Boston at their treatment by the officials of the New England Telephone & Telegraph Company. It is said that the company is making an effort to have all such lines placed in its care, and is intent on "freezing out" all who will not agree to its terms. A number of disputes are already on hand.

THE ELECTRIC LIGHT.

A Thirty-Mile District.—A company has been organized to establish at Fenelon Falls, Ont., a power light plant, and by means of suitable wires serve the district within a radius of 30 miles with the luminous current.

Richmond, Va.—The terms of the contract of the city and the Schuyler Company, giving the latter a five years' monopoly, are: For furnishing 100 arc lights, or more, of 1,200 candle power, on such streets as the committee may require, for the sum of $105.84 per light per annum, all repairs to be included in this sum; for furnishing private consumers with lights at a cost not to exceed $12 per month per light. The work of installation is now going on rapidly.

APPLICATIONS OF POWER.

An Electric Yacht.—There is now being constructed at Millwall, on the Thames, England, a small yacht which will be propelled by electrical power. The boat is thirty-six feet in length by seven feet in breadth. It is constructed of galvanized steel, lined inside with wood and lead. The accumulators are placed beneath the floor of the boat, so that, with the exception of a small compartment aft for the dynamos, the whole of the space is available for passengers. Two masts and a suit of sails are also fitted for use when required. In the course of a few days it is intended to take the yacht on a trial trip from Dover to Calais.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—Am. Cable, b 61¼, a 62¼; Am. Dist., b 17 a 22; B. & M., a 2.

Telephone.—Am. Bell, b 205, a 206; Erie, b 27, a 28; Mexican, b 1¼, a 1½; New England, a 32; Tropical, a 1⅛.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Anti-Magnetic Shields for Watches.—These shields, made by Giles, Brother & Co., State and Washington streets, Chicago, are an efficient protection to the works of watches from magnetism, as many testimonials in their possession show. This firm also demagnetize watches that are already affected.

The Warren P. Freeman Company have been very successful at the place of business in this city to which they have recently moved. They have now every facility for supplying electric light plants of any size, arc or incandescent. Their "earth open circuit" battery is in considerable demand. They supply also motors, and everything in the line of telegraphic and telephonic requirements.

The Electric Gas Lighting Company.—This well-known company, of 45 Milk street, Boston, Mass., manufactures and has in stock a splendid variety of electric gas-burners, including "automatic electric gas lighters and extinguishers," which may be lighted in series, for street lamps, gentlemen's drive ways, fire department houses, and for any out-of-door service. It also makes two styles of automatic gas-burners for single lighting in houses, churches, halls and stores. It has five varieties of simple hand-lighting burners, which do not contain the gas-key, but simply light the gas by the pull of a pending chain, after it is turned on by hand in the usual way. The company also carries eight varieties of pendent or ratchet burners, which do contain gas-keys, including the popular "Boston Ratchet No. 3," and the "Tip-Top Ratchet Burner No. 7," the argand candle, thumb-cock and billiard-table burners. It also has the "Vibrating Lighter and Burner," and the "Automatic Ring Lighter," for multiple lighting; and also carries a full line of electric gas-lighting supplies made expressly to go with its burners. The company has now a very strong management and directorate, and has been pushing of late into new territory, confident that the excellence of its goods and their low price must command a most liberal patronage everywhere. Its alliances and agencies throughout the country have been sagaciously chosen, and it is prepared to introduce its apparatus on the most extended scale wherever a demand exists.

Hill's Hair and Whisker Dye
Colors to any natural shade of black or brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure: 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS

PATENTS DATED AUGUST 11, 1885.

Electric Switch; Henry K. Goodwin, Cleveland, O., Assignor of ten-elevenths to the Ohio Molecular Telephone Company, of same place..... 324,248

The switch is adapted to be used in systems where two lines are employed, and consists of multiple contact pieces arranged to connect the proper circuits by one motion of the switch lever.

Electric Arc Lamp; Elisha B. Cutten, Pittsburgh, Pa., Assignor to the Electrical and Mechanical Development Company, of same place..... 324,305

In place of the usual tilting-clutch washer or ring, there is employed a clutch lever in which a ring is pivoted.

Arc-Lamp Regulating Mechanism; Bradley A. Fiske, Washington, D. C..... 324,311

The motion of the carbons is regulated by a piston moving in a cylinder, the piston being caused to move according to the fluid pressure in the cylinder.

PATENTS DATED AUGUST 18, 1885.

Telegraphic Cut-Out; Charles H. Lothrop, Lyons, Iowa..... 324,711

Consists of a tablet having upon the under side a pivoted bar with a long electrode upon one end and a short electrode upon the other end, both being insulated from each other, and terminals of the long and short line or circuit for the reception of said electrodes, which make contact therewith, and having upon the face of said tablet a lever for operating said bar, and a hand for indicating when the switch is off or on. By these means the electrodes can be made either to form part of the main circuit, allowing the current to pass through an instrument, or it can be made to divert the main circuit from the instrument, cutting out the same and leaving the short circuit broken.

Acoustic Telephone; William T. Black, Canton, O..... 324,356

He provides the call-plate with a button, the vibrations of which produce the signal.

Telephone Switch; John A. Cabot, New York, N. Y..... 324 358

Consists of a grooved pulley. The base of the groove is provided with metallic plates, one of which is electrically connected with one end of the conductor leading to the receiver. This plate is provided with a longitudinally-projecting spring adapted to bear against a metallic ring arranged on the side of the box containing the switch mechanism. The other end of the second conductor of the receiver is connected with the second metallic plate on the base of the groove mentioned above. This plate is provided with a spiral metallic spring, the lower end of which is electrically connected with a metallic block engaging with the metallic shaft carrying said grooved pulley. On one side of this pulley is provided a recess, to the interior wall of which is connected one end of a retracting convolute spring, the other end of which is fixed to a hub integral with or fastened to the outside of the frame forming a part of the box carrying the switch mechanism. This pulley is of course rigidly fixed to the shaft.

Electrical Annunciator; Robert Edwards, New York, N. Y..... 324,369

Consists in adding to the ordinary connecting wires generally used to complete the circuit in annunciator systems one or more conductors connected to complete an alarm-circuit, both the alarm and call circuits being adapted to operate the same indicator.

Railway Telegraph; Edward B. Ives, New York, N. Y., and Charles W. Williams, Cave City, Ky..... 324,381

Relates to a system of railroad telegraphy in which a continuous electric circuit from one point on the road to another point on said road is established and maintained through a car on the road between said points; and it consists in the application of compound levers and conact points to the armature levers, and in numerous details of construction.

Connector for Electric Batteries; Gustav Otto, Jersey City, N. J..... 324,410

Relates to a new construction of spring-clip, which, when applied to the proper parts of an electric battery, will constitute a coupling or device by which a circuit may be closed whenever desired. The spring-clip is U-shaped in cross-section, each of its arms being perforated.

Terminal for Electric Light Cable; William R. Patterson, Chicago, Ill., Assignor to the Western Electric Co., of same place..... 324,413

Consists in providing an air-space at the end of the cable, whereby moisture is prevented from being carried by capillary attraction to the paraffine or other insulating material of the cable.

Electrical Apparatus for the Propulsion of Vehicles; Frank Wynne, Westminster, Eng..... 324,447

The electricity is supplied from a stationary producer or reservoir to a well-insulated conductor in a covered way, and from this to the tram-car or other vehicle by the use of a small "carrier" or moving contact-maker, itself propelled by the same or part of the same current as the car, in conjunction with non-continuous metallic bars, in such a way that while, in the first place, the electricity is applied by means of the small moving carrier or feeder, in the next place no part of the metallic connection forming for the time being part of the electrical circuit between the insulated conductor and the tram-car is so exposed on the highway as to be liable to be brought into contact with the ordinary traffic.

Electro-Magnetic Car-Brake; Edward B. Hess, Louisville, Ky..... 324,470

Consists of the combination of a car mounted on wheels and having a platform for the driver, a brake hung freely opposite to the wheels, an armature fixed to the hanging brake, a horseshoe-magnet fixed to the car opposite to the said armature, two batteries of different power located on the car, a commutator pivoted to the car within reach of the driver, an electric connection between the said pivot and one arm of the horseshoe-magnet, electric connections

between the other arm of the said horseshoe-magnet and one of the poles of each battery, the terminal of the other pole of each battery located in the path of the said pivoted commutator, one terminal to form electric connection with the commutator when the latter is at one end of its path, and the other terminal to form electric connection with the said commutator when the latter is at the other end of its path, whereby the car-driver may readily apply the power of either the weaker or the stronger battery to the brakes.

Galvanic Battery; Ansonia, Conn., Assignor to the Ansonia Brass and Copper Company, of same place..... 324,475

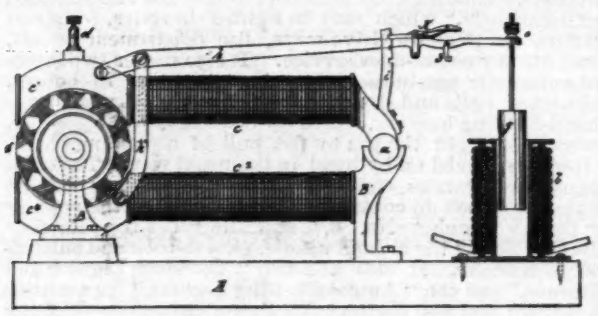
Consists of a copper plate perforated and grooved for the reception of the copper conductor, said conductor passing through the perforation and down below the lower edge of the copper plate, and being secured by the lower end of the conductor being turned up.

Electric Railway Controlling System; Charles A. Maijrhofer, Vienna, Austria-Hungary, Assignor of one-half to Carl Diener, of same place. 324,476

The road is divided into sections, each section being placed under the supervision of an official at a main station, and in each road section are arranged a series of contact posts at known or predetermined distances apart. Each post carries a separate contact-plate for each train that arrives at or leaves the main station, and each of said plates is in a separate electric circuit, in which is included an electro-magnet that controls an index hand or pointer that indicates the number of the post the train has passed by the closing of the main line circuit through the medium of a contact carried on the locomotive or a car, said circuit being closed either through an earth-return to a suitable generator of electricity at the main station, or through a generator on the said locomotive or car connected with the contact device carried thereby. In said main line circuit is also included a galvanometer, for purposes of testing line. The electro-magnet in the line circuit that controls the index or pointer also controls a recording instrument or chronograph in a local circuit, whereby a permanent record of the electric impulses sent to line is made.

Regulator for Dynamo-Electric Machines; Elihu Thomson, Lynn, Mass..... 324,501

Consists of means for simultaneously varying the flow of exciting-current on the main and derived circuit, and controlling devices responsive to changes in the speed



324,666. DYNAMO REGULATOR.

of the armature, whereby the flow of exciting-current may be varied correspondingly with variations in the speed.

Holder for Incandescent Electric Lamps; Frank M. Brown, Boston, Assignor to Nelson S. White, Canton, Mass..... 324,530

Brass pieces of semi-circular shape are secured to the holder, and are provided with notches for contact pins.

Method of Temporary Electric Lighting; Lazarus Goldenburg..... 324,551

Consists of the temporary electric-lighting appliance, consisting of a temporary or false molding or support, provided with electric conductors, in combination with temporary pillars or uprights for supporting the molding.

Current Regulator for Dynamo-Electric Machines; John A. Lannert, Cleveland, O., Assignor to the Buffalo Electric Works, Buffalo, N. Y..... 324,566

Relates to a regulator for controlling automatically the strength of an electric current flowing over a circuit embracing a dynamo-electric machine and one or more electric lamps or other devices in which the electric current is utilized by means of movable collecting-brushes, which are automatically adjusted toward or from the point of maximum strength to keep the current of the combination, with a revolving armature wound with two separate coils, one for the main current and one for the field current, and the field magnets, of a commutator connected with the main-current coil of the armature, a shifting commutator connected with the field-current coil of the same armature, an electro-magnet located in the main circuit and responding to changes in the strength of the main current, and a shifting train of shafts and gear-wheels, which is set in motion by said electro-magnet, and whereby the shifting commutator is adjusted to increase or reduce the field-current.

Commutator Brush for Dynamo-Electric Machines; Joseph A. Powers, Troy, N. Y..... 324,590

A spring plate is placed underneath the brush.

Telephone System; Charles W. Price and Albert Barrett, of Kansas City, Mo., Assignors to the American Bell Telephone Company, Boston, Mass..... 324,591

Consists of the combination of a switch-board upon which a series of sub-station lines are connected, a pair of connecting-cords with metallic tips united through a battery, a branch line having one terminal connected to earth and the opposite terminal to a metal plate or conductor, upon which the tips of the connecting-cords normally rest, and a battery-transmitter in the circuit of the branch line.

Secondary Battery; J. S. Sellon, Hatton Garden, County Middlesex, England..... 324,597

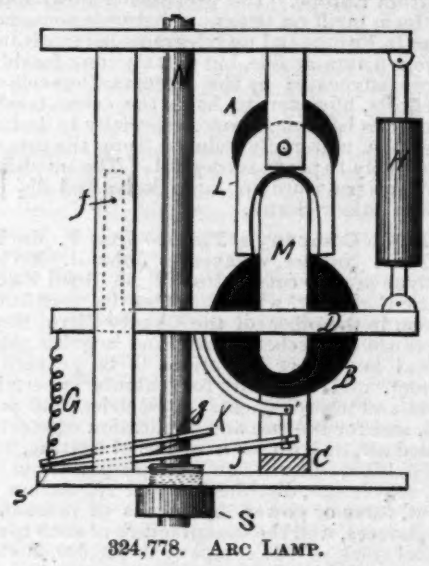
The secondary battery consists in the combination with a vertically-disposed element of a series of horizontally-disposed corrugated plates constituting the other element, said plates having their upper corrugations or grooves filled with active material, the lower grooves forming passages for the dispersion of the electrolyte, substantially as described.

Electric Elevator; Schuyler S. Wheeler, Newburg, N. Y..... 324,621

Consists of the combination of a normally-constant source of electric energy, its circuit, an elevator or support for raising and lowering matter, an electric motor in said circuit for hoisting said elevator, which motor may be caused to act at the will of the operator to raise the elevator, connecting mechanism between the motor and elevator, whereby the armature of the motor is mechanically driven when the elevator descends, thereby working the motor as a dynamic generator of electricity, and the means for utilizing the current thus generated.

Electrical Indicator; Murray Bacon, Philadelphia, Pa., Assignor to the Novelty Electric Company, of same place..... 324,635

Consists of the combination of the throttle-valve lever



324,778. ARC LAMP.

of an engine and an electrical switch operated thereby with an electrical indicator controlled by said switch.

Regulator for Dynamo-Electric Machines; Philip Diehl, Elizabeth, N. J..... 324,666

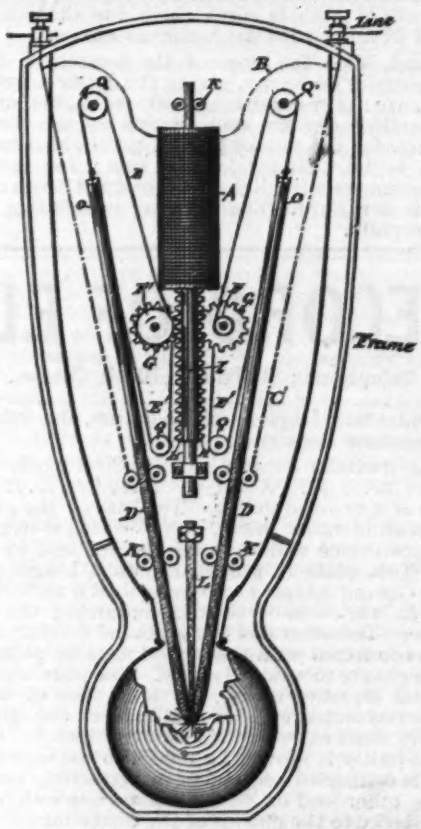
The object of this invention is to regulate the electromotive force in dynamo-electric machines, so that said motive force will be increased as the resistance which the current meets is augmented, and vice versa; and the invention consists in the means indicated by the claims for automatically varying the distance between an armature and the pole or poles of its field-magnet. The core influenced by the solenoid acts upon the lever, raising or lowering it, and drawing the hinged pole-piece away or toward the armature.

Electric Motor; Philip Diehl, Elizabeth, N. J.... 324,667

Consists of an adjusting mechanism comprising one or more levers for varying the position of the poles relative to the armature, as set forth.

Electrical Contact Point; Ezra T. Gilliland, Boston, Mass..... 324,678

Consists in providing on one electrode projections placed in position to precede the electrode proper in a movement across the face of its complementary electrode, thus scrap-



324,792. ELECTRIC ARC LAMP.

ing and cleaning the surface of such electrode and preparing a clean surface upon which the electrode proper may rest. The two electrodes are formed of metal or other good conductor.

Insulator for Securing Telegraph and Other Wires; George W. Hill, Quincy, Mass..... 324,692

Consists of plates of soft, yielding insulating material surmounted by a rigid clamping-plate, such plates having registering-perforations, and a fastening or clamping-screw passing through such perforations and into the support.

Galvanic Battery; Edwin F. Leighton, Boston, Mass., Assignor of one-half to James Sesson, of same place..... 324,708

He employs a hollow perforated cylinder of earthenware or other suitable material for use in galvanic batteries between the two electrodes, and provides them with a flange forming a trough surrounding it at or near the bottom, and adapted to fit the sides of the outer jar closely.

Electric Belt; Oscar F. Main, Marion, Ia., Assignor of two-thirds to Alden R. Sargent and Oliver S. Hall, both of same place..... 324,713

Consists of a single piece of waterproof material folded upon itself and forming a flap at its lower edge, and inclosing a voltaic chain adapted to be connected at its ends.

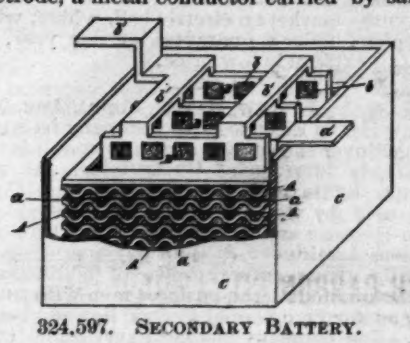
Telephone Transmitter; Thomas J. Perrin, New York, N. Y., Assignor to the National Improved Telephone Co., New Orleans, La., 324,726, 324,727, 324,728, and 324,729

1. The diaphragm carries two insulated contact buttons or electrodes against which opposite electrodes rest. The opposite electrodes are mounted upon hinged or swinging arms formed of magnetic material, and are just low enough that their opposite ends swing just opposite the north and south poles of a magnet bent in the form of a circle, and provided with an adjustable pole piece for acting on the swinging arms.

2. Modification of the above, the swinging arms being supported magnetically from the upper poles of the bent magnet and electrodes carried by the swinging arms and by the diaphragm.

3. By employing a central resonating chamber and separable tubes leading from thence each to an independent diaphragm he is able to connect or disconnect a transmitting-diaphragm with any of the tubes, so that he may use as many as the sounding-chamber affords connection for. Consists of the combination of an independent central resonating-chamber, jointed separable sound-conveying tubes radiating therefrom, and the transmitting diaphragms and electrodes.

4. Relates to that class of transmitters in which the electrodes rest in contact by gravity; and the primary object of the invention is to provide a connection between the loose electrode and the conductor of the primary circuit in which it is placed, which will permit the free jostling or rotation of the electrode around its support without in any way impairing its connection with the circuit. Consists of the combination of the diaphragm, the transmitting-electrodes, the upper one of which rests loosely by gravity on the lower one: a central pin or guide which passes centrally loosely through and prevents the displacement of the upper electrode, a metal conductor carried by said upper.



324,597. SECONDARY BATTERY.

electrode, and a mercury-well, into which said conductor dips, arranged on an arc concentric with said central pin

Magneto-Electric Telegraphy; Fred H. Brown, Fort Worth, Tex..... 324,746

A permanent magnet having coils is provided with an armature at one of its poles. The armature is free to vibrate over the other pole and may be operated by a suitable key.

Safety Device for Elevators; Robert M. Curtiss, Brooklyn, N. Y..... 324,751

Provides yielding transoms on the door of the elevator and electrical connections, and the stopping mechanism, whereby a collision with said transoms acts to stop the car.

Dynamo-Electric Machine; Hobrook Cushman, New York, N. Y., and Joseph P. Hall, Oldham, England..... 324,752

The armature consists of radial insulated spokes provided with forks at their outer ends.

Electric Car Brake; Charles E. Jones, Cincinnati, O..... 324,774

Consists in one or two improvements in detail of construction. The magnet possessed with end flanges being the principal improvement.

Arc Lamp; Osborn P. Loomis, Lynn, Mass.. 324,778

In a suitable frame, and upheld by suitable supports, is the magnet *A* in the main circuit, located above the armature *B* in a shunt-circuit, said armature being located above a fixed permanent magnet *C*.

The armature *B* is supported upon a lever *D*, fulcrumed at *f*, counterbalanced by a spring *G*, steadied in its movements by a dash-pot *H*, and connected up with the perforated discs *J* and *K*, having projections. There is a double ring clutch, which consists of the two annular discs *J* and *K*, through which passes the carbon holder *N*, and which are adapted to be set at different angles by the movements of the armature *B*, the two discs being separated by a spring, one end of which is fastened to one disc, and the other end of which presses upon the other disc, substantially as specified.

Electric Arc Lamp; Albert B. Worth, Brooklyn, N. Y..... 324,792

This invention relates to electric arc lamps provided with a refractory material between the electrodes.

L is a piece of refractory material supported so that it is located between the ends of the carbon electrodes. Each carbon electrode contains at one end a groove *M*, into which fits and is soldered a metal rod *N*, passing through a tube *O*, the said rod being the connecting-piece between the said tube and carbon electrode when the cap *P* is screwed upon it against the said tube, as shown.

The operation is simply that the electrodes, being in contact at first, burn away until there is an arc, when the magnetism increases in the shunt-magnet and pulls upward the combined core and ratchets. The cords thereby unwind from the drums and the electrodes feed downward and toward each other until they are completely consumed.

Copies of any of the Patents mentioned in this Record, can be obtained, with full specifications and drawings, from this office on application; price twenty-five cents each.